THE COSTS OF COMMUNITY AND INSTITUTIONAL CARE OF THE DEPENDENT ELDERLY

A thesis

submitted for the Degree

of

Doctor of Philosophy in Economics

in the

University of Canterbury

by

F.T. Green

University of Canterbury

1987

ACKNOWLEDGEMENTS

This thesis is based on research undertaken for the project "The Balance of Primary and Secondary Health Care", funded by the Medical Research Council. Several people have been involved at various stages of the project and I would like to acknowledge their support. The project was initiated and the original funding obtained by Professor Lawrence Malcolm and Pauline Barnett of the Health Planning and Research Unit in Christchurch and Professor Tony Rayner of the Department of Economics at the University of Canterbury. Refunding was obtained by Professor Tony Rayner, and Dr Jane Chetwynd of the Christchurch Clinical School.

Dr John George and Dr Don McNickle, both of the Department of Economics and Operations Research, University of Canterbury, offered criticism, advice, suggestions and welcome humour in the early days. Geof Fougere then of the Department of Sociology, University of Canterbury, gave helpful comments and encouragement. Dr Jane Chetwynd, and Judy Bethwaite, then at the Christchurch Clinical School, provided useful comments during the design of the questionnaire for data collection in the community.

I wish to gratefully acknowledge the funding received from the Medical Research Council and from the Health Services Research Committee.

This has been an applied project involving a large amount of data collection. I am grateful for the assistance and cooperation of the Principle Nurse and staff of the Coronation, Nurse Maude and the (then) Averill House hospitals; many personnel from the Canterbury Hospital Board, but particularly their accountant Gerard Thomas; the staff of the District Nursing Association particularly Morris Yates of the Accounts office, Barbara Stanton, Di Barnes, Judy Welch, the nursing supervisors and all the district nurses; personnel from the Presbyterian Support Services, the Anglican Social Services and the Red Cross Association, and lastly the 72 elderly people and their families who participated in the community study.

I also thank Margaret Mahan, who in addition to typing the manuscript accurately in spite of my handwriting, also offered a welcome ear when problems arose.

Most of all I must acknowledge my Supervisor, Tony Rayner, to whom I am most grateful for his continuing support and encouragement over several years. His particular blend of criticism and encouragement enabled me not only to complete the research, but also to enjoy it. I consider myself very fortunate to have had such a supervisor.

Lastly I thank Roger, my husband, and Ben, my son, for their patience, understanding and support, especially over the last six months.

CONTENTS

		PAGE
ABSTRACT		1
SECTION I	BACKGROUND, METHODOLOGY AND LITERATURE REVIEW ON COSTING THE CARE OF THE DEPENDENT ELDERLY	
	CHAPTER 1	
	INTRODUCTION	
1.1	Background to the Research	4
1.2	Subject of the Research	9
1.3	Objectives of the Research	12
1.4	Outline of the Research	14
	CHAPTER 2	
	CARE OF THE ELDERLY IN NEW ZEALAND	
2.1	Population Patterns	16
2.2	Expenditure on Health of the Elderly	20
2.3	Current Provision of Care for the Dependent Elderly	20
2.4	Identification of the Target Population	26
	CHAPTER 3	
	ECONOMICS OF COMMUNITY AND HOSPITAL CARE	
3.1	Problems of the Public/Private Sector Provider Interface	28
3.2	Problems Which Need to be Addressed	39
3.3	Context of the Research	42
	CHAPTER 4	
	METHODOLOGY OF COSTING EACH MODE OF CARE	
4.1	Inputs to Care	44
4.2	Approaches to Cost Estimation	50
4.3	Cost Estimation for Individual Elderly	54
4.4	Cost Estimation for Each Component of Care	55
4.5	How Costs Are Shared	62
4.6	Summary	62

CHAPTER 5

PREVIOUS RESEARCH ON COSTS OF CARE OF THE ELDERLY

5.1	Introduction	64
5.2	Comparative Costs of Alternative Modes of Care	64
5.3	Costs of Community Care	72
5.4	Disability-Related Hospital Costs	75
5.5	New Zealand Studies	76
5.6	Summary	78

CHAPTER 6

MEASURING DEPENDENCY

6.1	Objectives of Dependency Measures	81
6.2	Disability Scales and Classifications	82
6.3	Disability and Use of the Nursing Resource	86
6.4	Disability Clusters for Cost Reimbursement	89
6.5	Summary	92

SECTION II EMPIRICAL WORK ON THE COST OF CARE OF THE DEPENDENT ELDERLY

CHAPTER 7

DEPENDENCY AND USE OF THE NURSING RESOURCE

7.1	Introduction	94
7.2	The Samples	95
7.3	Data Collection	97
7.4	Results	103
7.5	Disability and Direct Nursing Care	120
7.6	Modelling the Disability-Direct Nursing Care Relationship	128
7.7	Implications of the Results	162
7.8	Summary	163

CHAPTER 8

THE COST OF PUBLIC HOSPITAL LONG-STAY CARE

8.1	Introduction	166
8.2	Hospital Sampled	166
8.3	Inputs to Public Hospital Care	173
8.4	Hotel Care	173
8.5	Nursing Care	202
8.6	Medical Care	222
8.7	Other Health Professional Care	225
8.8	The Total Cost of Long-Stay Care Related to Dependency	227
	Appendix	235

CHAPTER 9

THE COST OF PRIVATE HOSPITAL LONG-STAY CARE

9.1	Introduction	235
9.2	Hospitals Sampled	235
9.3	Estimation of Cost Components	246
9.4	Hotel Care	247
9.5	Nursing Care	254
9.6	Medical Care	268
9.7	Other Health Professional Care	275
9.8	The Total Cost of Private Hospital Long-Stay Care Related to Dependency	277
9.9	Estimating the Cost of Private Hospital Long-Stay Care	281
9.10	Who Bears the Cost?	293
	Appendix	303

CHAPTER 10

THE COST OF COMMUNITY CARE

10.1	Introduction	305
10.2	Community Sample	305
10.3	Inputs to Community Care	322
10.4	Accommodation Costs	322
10.5	Costs of Formal Agency Services	335
10.6	Paid Private Help	385
10.7	Costs of Informal Care	386
10.8	Medical Care Costs	430
10.9	Other Health Professional Care	440
10.10	Total Cost of Community Care	444
10.11	How Cost is Shared	460
10.12	Summary	473
	Appendix	477

CHAPTER 11

COST COMPARISONS BETWEEN MODES OF CARE

11.1	Introduction	480
11.2	Public and Private Hospital Long-Stay Care	481
11.3	Community and Private Hospital Care	516
	Appendix	547

CHAPTER 12

MAIN FINDINGS, CONCLUSIONS AND POLICY IMPLICATIONS

12.1	Summary of Research	552
12.2	Application of Results	557
12.3	Policy Implications	562
12.4	Conclusion	567
APPENDIX 1	Data Collection Forms	570
REFERENCES		580

ABSTRACT

Estimates have been obtained of the cost of care of the dependent elderly in private and public hospital and in the community, based upon information collected on samples of elderly in Christchurch, New Zealand. In order to properly compare the costs between modes of care, the estimates obtained were variable costs, related to patient dependency, and represented the cost of all resources provided, including informal care.

Using weighted least squares estimation, models were developed relating the consumption of direct nursing care in hospital to patient disabilities. These models explained a substantial proportion of the variability of the consumption of this resource.

Nursing care was identified as the major determinant of the variation between patients in the cost of hospital care. Estimates of cost for individual patients in public and private hospital were obtained as functions of the direct nursing care consumed, and were found to vary substantially between patients in each type of hospital.

The costs of public and private hospital care were compared, using the nursing care models to correct for the lower average dependency of the private hospital patients. The result was that private hospital care was cheaper although private hospital patients received more direct nursing care than did public hospital patients of the same level of dependency.

The cost of community care varied between individual elderly and was related to the level of dependency. Informal

care was the largest single component of this cost. Models relating informal and formal care to patient disabilities showed that informal care responded more strongly to dependency than did formal care.

Community care was found to be cheaper than hospital care for all patients sampled, the greatest cost difference being for the very dependent elderly.

These results emphasize the importance of including informal care when estimating the cost of community care and show the need for variable (disability-related) costs, rather than average costs, when planning for the care of the dependent elderly.

SECTION I

BACKGROUND, METHODOLOGY AND LITERATURE REVIEW ON COSTING THE CARE OF THE DEPENDENT ELDERLY

CHAPTER 1

INTRODUCTION

CONTENTS

		PAGE
1.1	BACKGROUND TO THE RESEARCH	4
	1.1.1 Introduction to the problem of Ageing for Health Expenditure	4
	1.1.2 Ageing of Populations	4
	1.1.3 Value of Increasing Expenditure on Health	5
	1.1.4 Increasing Role of the State in Health and Welfare	6
	1.1.5 Low Economic Growth	7
	1.1.6 Problems of Ageing Populations	7
	1.1.7 Expenditure on Health Care	7
1.2	SUBJECT OF THE RESEARCH	9
	1.2.1 Options for Care of the Dependent Elderly	9
	1.2.2 Balance of Community and Institutional Care	10
	1.2.3 Target Population of the Research	10
1.3	OBJECTIVES OF THE RESEARCH	12
1.4	OUTLINE OF THE RESEARCH	14

CHAPTER 1

INTRODUCTION

"In his plan, 7 October 1667, 'of lessening ye Plagues of London', Petty estimated that 'given the value of an individual and the cost of transporting people outside of London and caring for them for three months, thus increasing the probability of survival, every pound expended would yield a return of £84.'

"In 1676 in a lecture on anatomy, Petty noted that the value of better medicine was that it could save some 200,000 lives. Even valued at only £20, the lowest price of slaves, this was a large sum and better medicine therefore represented a sensible expenditure 'wherefore it is not in the interests of the state to leave physicians and patients to their own shifts.'"

The issues of value for money in spending on health care are not new. Fein (1971) quotes from works of Sir William Petty (1623-87) in which as Newhauser (1977) notes, are "the core concepts of cost benefit analysis". The quotes also establish the role of the state in the provision of health care.

The subject of the research presented in this thesis is the cost of care of the dependent elderly in hospital and community care. The problem of how to care for the dependent elderly is part of the wider issue of the effect on health expenditure of the increasing proportion of elderly people in the population. In the following section the background to this wider problem is described.

1.1 BACKGROUND TO THE RESEARCH

1.1.1 Introduction to the problem of ageing for health expenditure

There has been growing concern in Western Countries about public expenditure on health and of the effect on expenditure of the proportion of elderly in the population. This has been brought about by a combination of several factors: the ageing of the populations, the increasing responsibility of the state in the provision of health and social welfare, the low economic growth and the awareness that increasing the expenditure on health services may not necessarily result in increased health benefits. Each of these factors will now be discussed in the context of expenditure on health care.

1.1.2 Ageing of Populations

Better nutrition, housing and health care have increased the longevity of populations, so that for example, the life expectancy in Europe in 1975-80, is 72 years compared with 65.4 years in 1950-55 (United Nations 1981), or 48 years for a male born in England in 1901. The result is that the number of elderly (aged 65 or more) and particularly the 'old old' (aged 75 or more) has increased, and will continue to do so for some time. Furthermore the fertility rate, which has been demonstrated (Carrier 1962) to be the chief factor in determining the age structure of populations, has dropped in Western Countries, so that the proportion of elderly in the population has increased (see Table 1.1).

Grundy (1983) differentiates between countries whose populations have aged (e.g. United Kingdom), for which the proportion of elderly will remain relatively stable, and those

TABLE 1.1

PERCENTAGES OF ELDERLY (AGED 65 OR MORE)
IN POPULATIONS

Year	U.K.	U.S.A.	Australia	N.Z.
1901	4.7	4.1	3.8	4.1
1981	15.2 (1)	11.4	9.5 (2)	10.0
2001	15.2	12.2-12.9	11.0	11.6

(1) 1980
(2) 1979
Sources: United Nations' Demographic Yearbook (1983)
Older Americans U.S. Dept. of Health Education and Welfare (1978) Office of Population Censuses and Surveys.

whose populations are ageing (e.g. United States, Australia and New Zealand) where the proportion of elderly is still increasing. But she points out that there is an ageing process within the elderly sections of both types of population so that the proportion of 'old-old' continues to rise for both groups.

Many studies have shown that the likelihood of handicap or disability increases with age (e.g. Gibson and Rowland (1984), Salmond (1976), Jack, Dowland, Dourado and Hyslop (1981)). In particular, the probability of being disabled increases sharply at 75 years. For example although in Australia 32 percent of people aged 65 years and over are disabled in some way, the proportion for the 'young-old' (65-74) is 24 percent, and for the 'old-old' (75 and over) it is 46 percent (Gibson and Rowland (1984)). Hence growth in this sector of the population leads to growth in the number of disabled people and increased demands on health services.

1.1.3 Value of Increasing Expenditure on Health

The post war period was a time of expansion of health care facilities. The policy was to provide health services to meet need. Expenditure on health care duly increased. The implicit assumption on which this policy was based, was that higher expenditure would result in increased health benefits. These benefits are difficult to quantify but the simplest measure is mortality. Comparison of mortality rates between countries show no consistent correlation of low mortality with high spending (Maxwell 1981). As McKeown (1976) has argued, there are many other contributing factors to good health in addition to health services per se, and points to the part played in the past by improved nutrition, housing, sanitation and clean water. Differences in mortality now exist for different socio-economic groups (Dept. of Health and Social Security, 1980) and this reflects to some extent lifestyle effects e.g. of smoking, diet etc., which are not readily changed by spending on health services. Therefore the effectiveness of continuing to increase expenditure on health care has been called into question.

1.1.4 Increasing Role of the State in Health and Welfare

Since the beginning of this century, but particularly during the post-war period, most Western countries have increased the level of involvement of the state in health and social welfare, e.g. through state pensions and the National Health Service in the United Kingdom, and programs such as Medicare and Medicaid in the United States. The elderly are heavy users of these services so that if the number of elderly in the population increases, public expenditure will rise. Gross (1984), from an analysis of cross-sectional data on 11 countries for the years 1957 and 1977, suggests that if the proportion of people aged 65 or more in a population increases by 10 percent, there is a 14.15 percent increase in the expenditure on benefits for the aged, veterans and disabled.

1.1.5 Low Economic Growth

The fourth factor is that, in the wake of the oil crisis of 1973 most Western countries have experienced a period of low or zero economic growth and rising unemployment, so that increasing government expenditure on health services would contribute to a higher budget deficit.

This coincided with a shift in thinking away from the Keynesian view that fiscal deficits promoted growth in the economy, to the opposite view that they inhibited it, by reducing the investment available for the private sector. The result is that many countries are now endeavouring to keep their fiscal deficits down by controlling government expenditure, so that after a period of expansion of health services, and of the role of the state in providing and/or funding services, public expenditure on health is now constrained.

1.1.6 Problems of Ageing Populations

The factors above have combined to bring a number of problems to the forefront of the political and social agendas. There is the overall problem of how to fund an 'acceptable' level of health care. Then, specific to the elderly themselves is firstly the problem of ensuring that sufficient funds are available to maintain what are considered to be 'adequate' pensions for retired people, and secondly how to care for the disabled elderly. The last problem is the subject of this thesis. Since it is part of the wider problem of providing health care this will be discussed in the next section.

1.1.7 Expenditure on Health Care

The problem of how to fund an acceptable level of health care has led to many countries examining their own systems of health care in terms of the level and type of provision, the method of funding and the associated costs. Comparisons have been made of health care systems between nations (e.g. Abel-Smith and Maynard (1979) and Abel-Smith (1984)) in order to identify ways of containing costs.

Expenditure on health care varies widely between the developed countries (see Table 1.2). In 1975 expenditure as a percentage of Gross National Product ranged from 5.5 percent in the U.K., to 9.4 percent in West Germany.

TABLE 1.2

TOTAL EXPENDITURE(1) ON HEALTH CARE(2)

	U.S. dollars per head (1975)	Percentage of GDP 1975	Elderly as %age of total population (1974
Sweden	717	8.5	14.9
West Germany	638	9.4	13.9(3)
United States	607	8.6	10.3
Switzerland	599	6.9	12.1
France	518	7.9	13.6(3)
Canada	508	7.1	8.4
Netherlands	491	8.1	10.6
Australia	464	7.3	8.4(3)
United Kingdom	226	5.5	14.0
Italy	224	7.1	11.8

(1) The estimates are of public and private expenditure
(2) Source: Maxwell (1981)
(3) 1973 data

Cooper (1984) discusses some possible determinants of expenditure on health care and concludes that the relationship is complicated, and is not simply related to the age structure of the population. Richer countries spend more on health, both in absolute terms and as a proportion of GDP. There is no obvious relationship between the level of expenditure and the proportion of total expenditure which is incurred by state owned organizations or the proportion of total expenditure which falls to the consumer. Cooper also points out the personal nature of an acceptable health system in a country i.e. particular to the populace, so that it is for each country to determine its own particular mix of public/private provision, state/consumer contributions and so on. A problem of all systems seems to be the difficulty of effecting swift change in the supply of health care with the result that it is difficult to curb expenditure in the short-run.

1.2 SUBJECT OF THE RESEARCH

A problem within the health care field is caring for the dependent elderly, those who cannot manage their everyday lives without assistance. Most elderly people remain well and independent but some will become disabled.

1.2.1 Options for Care of the Dependent Elderly

There are several options for elderly people who cannot take care of themselves. The main choice is between community and institutional care. In the community, help is provided from informal sources (family and friends) and from formal support services (e.g. home help, home nurse). Institutional care includes residential homes for elderly who require 'hotel' services but can mainly look after their own personal needs, and nursing homes, where personal services are provided. In some countries, very dependent elderly are cared for in geriatric hospitals of geriatric wards of general hospitals.

The problem of caring for increasing numbers of dependent elderly during periods of low or zero economic growth has led to many Western countries examining their provision of each type of care and comparing it with what other countries offer. Since the 1970s there has been a great deal of literature on the subject including much prepared and resulting from the World Assembly of Ageing in Vienna in 1982 (e.g. Andrews (1985), Smith (1983, 1984a, 1984b), Donaldson (1980), Lawrence, (1985)).

1.2.2 Balance of Community and Institutional Care

The proportion of elderly being cared for in institutions varies between countries. For example in the United Kingdom 4.8 percent of elderly people are in institutional care compared to 5 percent in the United States, 5.9 percent in New Zealand, and 6.4 percent in Australia.

In the past, institutional care was regarded as the better option for very disabled people (particularly those with mental disorders). In recent years however, there has been a move away from institutional care in favour of community care. It is recognized that given the choice dependent elderly people prefer to remain in their own homes as long as possible.

The various care options for dependent elderly are not equally costly. The increasing numbers of dependent elderly at a time when funds for health care are constrained has focused attention on alternative modes of care. Community care is thought to be less expensive than institutional care. It is this issue which will be addressed in this thesis.

1.2.3 Target Population of the Research

The dependent elderly may be defined as those who cannot manage the essential tasks of everyday living without assistance. Inability to perform personal care tasks i.e. eat, toilet, dress, wash or bath, without help, are clear indicators of dependence, and elderly people with these disabilities would be 'at risk' of entering long-stay hospital (or nursing home) care if adequate community care were not available.

There are many elderly people, however, who can manage these tasks but require help with domestic tasks such as cooking, cleaning, laundry and home maintenance, which are lower down in the dependency hierarchy (Williams, Johnston, Willis and Bennett (1976)). Difficulties with domestic tasks and/or problems of social isolation, could lead to admission to long-stay residential care rather than hospital care.

This thesis is restricted to the study of the first group i.e. elderly who are sufficiently dependent to warrant geriatric hospital care. They would require assistance with one or more of the personal care tasks listed above and hence would require some nursing care. Virtually all such elderly would also be unable to manage the domestic tasks.

Dependence in the specified areas could be on account of physical or mental impairment, which in turn is the outcome of a variety of chronic medical conditions.

A person with these dependencies consumes a certain level of health resources. Some is due to the dependency, but part would have been consumed even if the elderly person had not been dependent. The research to be presented, is concerned with care on account of dependency and hence does not measure the total consumption of health resources. The research is confined to resources used for the regular, ongoing care for maintenance of function. In particular, treatments in general hospital for medical conditions e.g. surgical procedures, are excluded.

The research was not directed specifically at psychogeriatric elderly (although some of the elderly studied could be so categorized).

1.3 OBJECTIVES OF THE RESEARCH

The major objective of the research is to compare the cost in different modes of care. The care modes considered are public and private geriatric hospital care, and community care.

Since the elderly population is itself both increasing and ageing, and since disability increases with age, the numbers of elderly disabled people are increasing. Moreover there will be a distribution of the level of disability within the population of dependent elderly. Rather than treating the dependent elderly as a homogeneous group it is more useful in terms of predicting the total demand for services, to consider the level of dependency. An important feature of this research is the identification of resources for which the level of use would vary between individual elderly (on account of their disability). This allows the estimation of costs in each mode of care, which are related to the disability of the elderly. In this way comparisons of cost between modes of care are possible for patients at a particular level of dependency.

One group of elderly of particular interest are those 'at the margin' of a mode of care i.e. those living at home who would be likely to enter hospital care if there was a small change in their physical circumstances or support system, or those in hospital care who could with adequate support services be cared for at home. These 'at the margin' elderly, are likely to be the less disabled of the hospital patients and the most dependent of those in the community care. They are likely to be most affected by changes in policy of care for the aged, and any cost estimation must be sufficiently sensitive to be applied to this group. Such a group are identified from the sampled data and their costs of home and hospital care are compared.

A second consideration when comparing costs between modes of care is that the share of the cost to the family and the state may be different according to the mode of care considered. Therefore the research sets out to identify how costs are shared. A second distinguishing feature of the research is that the cost of unpaid resources (e.g. family help) are included in the analysis in order to properly acknowledge the contribution of these inputs.

The costs and benefits of each mode of care are restricted to the measurable resources consumed by elderly and do not include intangible benefits e.g. of being at home.

The detailed objectives are listed below.

The initial objectives are to determine for each mode of care:

(1) the levels of all resources used

(2) the cost of providing these resources

(3) to identify resources which may vary between individual elderly

(4) to identify patient characteristics which determine resource use

(5) to model the relationship between patient characteristics and use of resources

(6) to estimate the cost of care for individual patients with specified disabilities i.e. disability-related cost estimates

(7) to estimate the share of the cost borne by the state, the elderly and the family

The disability-related cost estimates for each mode of care will enable the following overall objectives to be fulfilled:

(8) to compare the cost between modes of care in terms of the amount of resources used, the total cost of care and the share of the cost to the state and the family

(9) to describe and criticize the provision of care for the dependent elderly in New Zealand, and to suggest changes for improvement based on the research.

1.4 OUTLINE OF THE RESEARCH

The thesis is in two parts. The first part (chapters 1-6) describes the problem situation and develops the methodology of the research. The second part (chapters 7-12) contains the results of empirical work on care of the dependent elderly.

Chapter 1 describes the background to the research. In chapter 2 the problem of caring for the dependent elderly in New Zealand is described. In chapter 3 the economic arguments of home and hospital care are discussed. In chapter 4 the costs to be estimated and methods for their estimation are detailed. Chapters 5 and 6 contain a discussion of the main literature on cost comparisons between modes of care and on measuring costs and resources related to disability.

The empirical work presented in the second part of this thesis is based on separate studies which have been conducted in public and private hospitals, and private households in the community. Samples of elderly people were taken in each care setting. Disabilities and other patient characteristics were measured and the amounts of resources used for care e.g. nursing time, doctor visits were estimated.

Chapter 7 compares the disability levels of elderly in each mode of care and explores the relationship between one resource i.e. direct nursing care, the most important determinant of the variation in cost between patients in hospital care.

Detailed costing studies were undertaken to estimate the cost of providing the inputs to care in each care setting. The results of this are presented in chapters 8 to 10. Two important features of this research are the estimates of disability-related costs for each mode of care (chapters 8-10) and the inclusion of the cost of informal care in the cost of community care (chapter 10). In chapter 11 the disability related costs are used to compare the cost of public and private hospital care, and community and hospital care. Chapter 12 contains the main findings of the research and some policy implications.

CHAPTER 2

CARE OF THE ELDERLY IN NEW ZEALAND

CONTENTS

		PAGE
2.1	POPULATION PATTERNS	16
2.2	EXPENDITURE ON HEALTH OF THE ELDERLY	20
2.3	CURRENT PROVISION OF CARE FOR THE DEPENDENT ELDERLY	20
	2.3.1 Institutional Care	20
	2.3.2 Community Care	24
2.4	IDENTIFICATION OF THE TARGET POPULATION	26

CHAPTER 2

CARE OF THE ELDERLY IN NEW ZEALAND

2.1 POPULATION PATTERNS

The majority of New Zealand's population are of European extraction and enjoy a similar standard of living, lifestyle etc., to the populations of western developed countries. Like them, New Zealand's population has experienced falling birth rates, increasing longevity[1] and increasing numbers of elderly, hence one might expect a similar pattern of ageing to emerge. There are however some important differences. Firstly, New Zealand has been kept, for a period, a 'young' country, its population fed by large numbers of immigrants, particularly during the 1950's.

Before the 1950's, as a result of a higher standard of living and declining birthrate, the elderly were increasing, both in absolute numbers and as a proportion of the total population. During the period 1951-1976 the number of elderly continued to increase, but the increase in the proportion of elderly in the total population was arrested by the growth in total population,[2] caused by a combination of the effects of high immigration and a high birth rate (O'Neill, 1983).

In the 1970's the birthrate declined once more and there were net migration losses, so that the rate of increase of the

---

1 Life expectancy in 1981 was 70 for men and 77 for women.

2 The population increased from 1.94 million to 3.13 million during the years 1951-76, an increase of 61.3 percent.

total population declined.[3] The proportion of elderly in the population duly increased. The situation in the 1980's is of an ageing rather than an aged population. New Zealand will therefore be facing the problems of ageing, described in Chapter 1, for some time to come.

In 1981, 9.96 percent of the total population were aged 65 years or more, compared to 9.15 percent in 1951. This proportion is predicted to rise to 11.64 percent in 2001 (see Table 2.1) and unlike other western countries it will continue to rise. It is predicted to be 14.2 percent in 2016, by which time the children of the first five of the 'baby-boom' years will have reached 65 years.

TABLE 2.1

ACTUAL (1951-81) AND PREDICTED (2001-2016) NUMBERS AND PROPORTIONS OF ELDERLY (AGED 65 OR MORE) IN THE TOTAL NZ POPULATION

Year	Number Aged 65 years and over	Total Population	Percentage
1951	177,459	1,939,472	9.15
1976	279,507	3,129,383	8.93
1981	316,191	3,175,737	9.96
2001	439,200	3,772,500	11.64
2011	598,100	3,928,700	12.68
2016	567,200	3,979,700	14.25

Source: Census of Population and Dwellings 1981, Dept. of Statistics.

The proportion of 'old-old' is also increasing from 2.7 percent of total population in 1951 to 3.53 percent in 1981

3 In fact O'Neill (1983) has found that migration loss exceeded natural increase so that the total population declined during 1979-81.

(see Table 2.2). It is predicted to rise to 5.53 percent in the year 2016 and O'Neill (1983) has predicted a further increase to between 8.5 and 9.6 percent of the total population for the year 2036.

TABLE 2.2

ACTUAL (1951-81) AND PREDICTED (2001-2016) NUMBERS AND PROPORTIONS OF THE 'OLD-OLD' IN THE TOTAL NZ POPULATION

Year	Number Aged 75 years and over	Percentage of total population	Percentage of all elderly
1951	53,054	2.77	29.9
1976	97,204	3.11	34.8
1981	112,149	3.53	35.5
2001	199,000	5.27	45.3
2011	209,200	5.32	42.0
2016	220,200	5.53	38.8

Source: Census of Population and Dwellings 1981, Dept. of Statistics.

A second feature which distinguishes New Zealand from other developed countries is the fertility rate, which although decreasing is on the high side (1.9 in 1981 compared to 1.4 for West Germany, 1.7 for Sweden, 1.8 for the USA - United Nation's Population and Vital Statistics Report (1983)). There is thus the possibility of further reduction following European patterns. On the other hand many western countries have experienced 'recuperation' in their fertility rates because of the delayed births of older couples. Hence it is not clear whether fertility will continue to fall or to increase over the next few years. New Zealand will also be affected by migration patterns. The report of the Population Monitoring Group (1984) concludes that population growth will be slow and O'Neill (1983) predicts an eventual decline.

The ability to adequately care for the increasing number of elderly in the population depends upon, among other things, the numbers of people in the labour force. Although the

TABLE 2.3

ACTUAL (1951-81) AND PROJECTED (2001-16) NUMBERS OF ELDERLY AND 'OLD-OLD' PER 1000 OF LABOUR FORCE

	Number of Persons aged 65 or more per 1000 of labour force		Number of Persons aged 75 or more per 1000 of labour force	
1951	240		72	
1981	237		84	
	low	high	low	high
2001	261	244	118	110
2011	284	265	119	111
2016	323	301	125	117

Sources: Census of Population and Dwellings 1981, Dept. of Statistics. Projections of Total New Zealand Population 1983-2016 (base 31 March 1982), Dept. of Statistics.

population is predicted to increase only slowly, there are increasing numbers of women entering the workforce and the labour force is predicted to increase by 25 percent between 1981 and 2001. Over the same period the elderly will increase by 40 percent and the 'old-old' by 77 percent (see Tables 2.1 and 2.2). As a result the number of elderly people per 1000 full-time members of the workforce will increase (see Table 2.3). The increase has already started for the number of 'old-old' per 1000 of the labour force (comparing the years 1981 and 1951) and is predicted to continue.

By the 21st century, there will be at least 110 people aged 75 years or more for every 1000 in the workforce. This is an increase of 31 percent over the levels in 1981.

2.2 EXPENDITURE ON HEALTH OF THE ELDERLY

Public expenditure on vote health in New Zealand was 14.98 percent of GDP in 1979/80. In that same year the elderly comprised 9.7 percent of the population, yet it has been estimated (Sutton, 1983) that expenditure on this group accounted for 33.8 percent of vote health. Expenditure per elderly person was estimated at $1,165 per year (compared to $214 for the 0-14 age group and $259 for the 15-64 age group). Eighty percent of this sum was for hospital services. In 1979/80 the elderly accounted for 49 percent of bed days in public hospital (Hospital and Selected Morbidity Data, 1981) and 83 percent of bed days in private hospital (Sutton, 1983).

2.3 CURRENT PROVISION OF CARE FOR THE DEPENDENT ELDERLY

The provision of institutional care and community support services for the dependent elderly is summarized in Ageing New Zealanders (1982).

2.3.1 Institutional Care

(a) Current Provision

In New Zealand institutional long-stay care is provided at two levels: geriatric hospital care and residential home care.

(i) Geriatric Hospital Care

Long-stay hospital care is provided for elderly people suffering from chronic disabilities and medical conditions, who need access to '24-hour nursing care' but do not require significant amounts of specialist medical care. Patients are seen on a regular basis by doctors who monitor their condition and provide general medical care e.g. prescribing drugs etc. but patients are moved to a general hospital for treatment of acute medical problems e.g. surgery. Trained nursing staff are on duty throughout the day and night. Assistance is given with all aspects of personal and domestic care. This form of care is similar to that provided in the nursing homes of Australia and the United States, and is available in both the public and private sector.

In the public sector, long-stay hospital care for the elderly is available in geriatric hospitals or long-stay geriatric wards of public general hospitals. Public hospital care is provided by regional Hospital Boards and paid for out of government revenues. There is no charge to the patient.[4]

In the private sector, long-stay geriatric hospitals are run by both profit making, and non-profit making organizations (the latter are termed 'religious and welfare' organizations). Private hospitals have two sources of income. The Department of Health subsidizes patients in private geriatric hospitals. A patient fee is also charged, the amount varying between regions and between hospitals within a region. The Hospital Boards subsidize these fees for a limited[5] number of private hospital patients.

Nationally, the provision of geriatric beds in the private sector exceeds that of the public sector. In 1983 there were 2,880 public hospital beds and 3,416 private hospital beds[6]

---

4 However, the state witholds all but a small part ($5 in 1983/84) of the National Superannuation payment.

5 Since 1983 the number of subsidized beds in private hospital has been governed by the population funding formula (Smith and Sutton 1984) which stipulates the total provision (both in the public and private sector) of geriatric beds in a region, based on the number of elderly in the population.

6 Of these, 1,837 were offered by private organizations and 1,671 by religious and welfare organizations.

(N.Z. Health Statistics Report, 1983). In addition, there are a number of elderly patients in acute wards of public general hospitals who have finished the treatment appropriate for the medical condition for which they were admitted, but have not yet been discharged. Some of these are waiting for a long-stay hospital bed and so could be considered to be in long-stay hospital care. Precise estimates of the number of elderly in this situation are not available.

(ii) Residential Home Care

Residential Homes provide an intermediate level of care for the frail elderly, who whilst not sufficiently dependent to require geriatric hospital care, could not manage to live at home without assistance. All domestic care and a limited amount of personal care e.g. bathing, dressing, is provided.

Only a small proportion of residential care beds are provided by the state. In 1983 there were 919 Hospital Board beds out of a total of 12,992. 4,268 beds were provided by privately run organizations (called rest homes) and 7,805 by Religious and Welfare organizations (King, Fletcher and Main 1985).

There is no requirement for qualified nursing staff in rest and residential homes[7] but many homes do employ a limited number of nurses. The type of care offered is similar to that of Old People's Homes in the United Kingdom.

The sources of funding differ according to the ownership of the home. Public residential homes are fully funded (via the Hospital Boards) from government revenues. Residents of the private rest homes, in most areas of the country, who have been

---

7 The Dept. of Health stipulates that there must be at least one staff member per five residents housed.

assessed as frail ambulants, are eligible to obtain a (means-tested) state subsidy of their fees. Residents of the Religious and Welfare Homes are not eligible for this subsidy and may apply only for a (relatively small) accommodation benefit. On the other hand there is a state staffing subsidy available for the Religious and Welfare Homes.

(b) Recommended Provision

The planning guidelines for long-stay geriatric care of the elderly (N.Z. Dept. of Health 1977) recommend 18 beds per 1,000 people aged 65 years or over. A survey of accommodation needs for the elderly (Salmond, 1976) estimated the required number of residential home beds at 30 per 1,000 people aged 65 years or more. The estimated elderly population was 325,750 in

TABLE 2.4

RECOMMENDED AND ACTUAL PROVISION OF LONG-STAY CARE FOR THE ELDERLY IN NEW ZEALAND (1983/84)

	Recommended Beds		Available Beds	
	Total	%age of Elderly Population	Total	%age of Elderly Population
Geriatric Care	5,863	1.8	6,296	1.9
Residential Care	9,772	3.0	12,992	4.0
Total	15,635	4.8	19,288	5.9

1983. In Table 2.4 the recommended beds for this population are compared with the beds available.[8] The guidelines are exceeded for both types of care, but particularly for residential care. One might infer from this that the guidelines

8 Not all long-stay geriatric beds in public hospital may in fact be occupied by elderly people. Some are used by adult (non-elderly) long-stay patients. However the number is probably compensated for by elderly occupying acute beds in general hospitals.

are set too low, but in fact the level of provision of institutional beds is high in New Zealand, compared to many other countries (see section 1.2.2). Moreover the proportion of 'old-old' in the elderly population, for whom the incidence of disability is greater, (see section 1.1.2) is lower. Therefore it follows that the relative provision of institutional care in New Zealand, for the population served, is even higher when compared to many other countries.

There would therefore seem to be an oversupply of beds. Yet there is a waiting list for geriatric hospital care, and those on the waiting list are elderly who have been assessed to be in need of this form of care. To some extent excess demand for health services is a function of the health care market (discussed in Chapter 3) but the implication of excess demand in a situation of excess supply is that there is some inappropriate allocation of geriatric beds.

2.3.2 Community Care

Care of elderly people of the full range of dependency, takes place in ordinary households in the community with formal support from agencies, and informal support from family and friends. It has been estimated (Salmond, 1976) that one third of all severely disabled elderly are cared for at home.

There are several sources of help in the community. Formal support is provided by agencies e.g. home nursing, meals on wheels, etc. The level of provision and type of funding varies throughout the country. The state is involved in the organization and funding of many community services offering personal and domestic care. Voluntary agencies are involved in a wide range of services, mostly domestic care and property maintenance. Some services are free to all elderly (e.g. home nurse) for others a fee is charged. State subsidies are available for some services (e.g. home aid). Formal agency services are described in detail in Chapter 10.

Salmond (1976) identified a substantial shortfall in the provision of all formal community services, apart from home nursing, when comparing actual to required provision. Unmet need has been identified more recently for home services, especially simple personal care, home help (housekeeping) and home sitters (Jack, Dowland and Hyslop, 1981). It is acknowledged that formal agency services provide only part of the assistance which disabled elderly people require at home. Some elderly pay for help from private individuals or agencies but this is not widespread, and the main source of help is the family (Koopman-Boyden) supplemented by assistance from friends and neighbours. This form of help is unpaid and is termed 'informal' care. A list of services provided by informal carers is given in Chapter 10. It includes personal and domestic care and extends to help with property maintenance and management of finances.

Medical care is available through general practitioners. The state subsidizes this care for people aged 60 or more at a higher rate than for people who are under 60. The state also provides free of charge some therapy services but the level of provision is insufficient in some areas. Disabled elderly may apply to the Department of Social Welfare for a small benefit to put towards disability-related expenses. Most elderly live in their own home (or their family's) but the state provides (at low rent) a limited amount of pensioner housing and offers suspensory loans for property alterations required on account of disability.

The most recently introduced scheme is the 'relief-for-carer' facility which allows disabled elderly a period in institutional care (at no cost) to provide relief from caring for the family.

The above outline of provision of community care describes a wide range of services. Unfortunately the level of provision of these services is often too low. Expenditure on community services is only a fraction of what is spent on hospital services. Nevertheless a significant number of very dependent elderly are cared for at home and rely on their families for help.

2.4 IDENTIFICATION OF THE TARGET POPULATION

In order to identify the target population of dependent elderly (as defined in 1.2.3) the dependency of elderly in each mode of care must be considered.

A national survey of the elderly in 1972/73 (Salmond, 1976) measured the functional capacity of elderly in institutional and community care. Elderly in public hospital were on the average more dependent than those in private hospital. Similarly elderly in religious and welfare residential home care were more dependent than those in private rest homes. There was however, an overlap in terms of dependency of elderly in each type of care and the survey identified substantial inappropriate allocation of elderly to mode of care. It was estimated that two thirds of elderly in long-stay hospital care were 'severely disabled', compared to only 9.1 percent in residential care. Over one-third of the total severely disabled elderly were living in the community.

A survey of elderly in the Christchurch area found that

61.8 percent of elderly in geriatric hospital care were not mobile without assistance, compared to 8.4 percent of those in residential homes (Scotts, 1979). Twelve percent of all elderly who were 'not mobile without assistance' lived in the community but the sample was too small for this estimate to be reliable. A survey in the same area in 1983 estimated that 46.0 percent of elderly in hospital care were of 'high dependency, compared to only 5.5 percent of elderly in residential care (Sainsbury, Fox and Shelton, 1986).

From the results of these surveys it can be concluded that most of the target population would be either in long-stay geriatric hospital care or being cared for at home. But in view of the overlap of type of patient in the various modes of care, some of the target population could be in residential homes. The research to be presented is based on one area in New Zealand (Christchurch) and considers elderly in public and private hospital and in community care. Limited resources were available for data collection and there were few of the target population to be found in residential care in the Christchurch area. Therefore elderly in residential care were not included in the research.

CHAPTER 3

ECONOMICS OF COMMUNITY AND HOSPITAL CARE

CONTENTS PAGE

3.1	PROBLEMS OF THE PUBLIC/PRIVATE SECTOR PROVIDER INTERFACE		28
	3.1.1	Overview of Current Situation	28
	3.1.2	History and Results of State Intervention	30
	3.1.3	Difficulties of Providing the Appropriate Balance of Care	35
	3.1.4	Effect of Current System on the Consumer	37
3.2	PROBLEMS WHICH NEED TO BE ADDRESSED		39
	3.2.1	Lack of Information for Planning	39
	3.2.2	Information Required to Compare Modes of Care	40
	3.2.3	Strategic Uses of Information	42
3.3	CONTEXT OF THE RESEARCH		42

CHAPTER 3

ECONOMICS OF COMMUNITY AND HOSPITAL CARE

Provision of care for the dependent elderly is a microcosm within the health care market. In this chapter, the production and consumption of the goods and services which make up "Care of the dependent elderly" are discussed. The types of products (options for care) will be considered, and the implications of the system of providing and funding this care will be explored from both the consumer and producer perspectives. Since care of the elderly is provided in both the public and private sector, both viewpoints will be considered.

3.1 PROBLEMS OF THE PUBLIC/PRIVATE SECTOR PROVIDER INTERFACE

3.1.1 Overview of Current Situation

The state is the major provider and funder of health care in New Zealand. In addition to directly providing much health care, the state contributes to the funding of many services in the private sector and the state is seen as having the responsibility for the overall provision of health care. This also applies to long-stay hospital care of the elderly where the state provides just under half of the total beds and also subsidizes the private hospital beds. The state is therefore concerned with problems of ensuring correct allocation of services (equity), as well as 'value for money' (efficiency and effectiveness) in the provision of care of the dependent elderly.

The products funded (wholly or partly) by the state are geriatric hospital care, residential care and community care (described in section 2.3). Not all products are available to all elderly. Access, to some, is limited by patient dependency. Nevertheless some product substitutions are possible. For the most dependent elderly public and private hospital care and community care are provided; for those less dependent, the choice is between residential care and community care.

In persuing its goals of effectiveness, efficiency and equity in the delivery of health care the state has available various strategies. It can alter the 'market share' of each of the 'products' considered above i.e. it can change the mix of public and private beds and the ratio of institutional to community care. This can be done by regulations i.e. by limiting the numbers of beds or by funding mechanisms e.g. to encourage the growth of the private sector, or to ensure the right 'type' of elderly consume the appropriate products. It can institute new forms of care and it can make improvements to existing care options.

When reviewing the history of state activity in health care it can be seen that the state has followed the well-worn path (described by Maynard, 1982) taken by many other countries who are now faced with providing health care at reasonable costs. The problem of efficiency has not been addressed directly.[1] Instead budget constraints have been imposed to limit expenditure. The problem of equity has been tackled by a geographical distribution of the health budget according to the size of the population, weighted by 'need-associated' factors

---

1 Until recently, when funds for health care became constrained, efficiency seemed not to be addressed at all. Health care budgets each year were a bit more than the year before, in the belief that more input would lead to more output.

e.g. numbers of elderly etc. in an area (Smith and Sutton, 1984) and by making subsidies available for 'special' cases of need e.g. disabled elderly unable to afford private geriatric care. Emphasis has not been given to ensuring that reduced expenditure results in greater efficiency or that the geographical redistribution of health resources results in these being consumed by the 'correct' groups, or that what was recommended as an appropriate form of care was in fact the most effective.

3.1.2 History and Results of State Intervention

(a) Geriatric Hospital Care

In the period from the 1940's to the 1970's the concern was to expand health care facilities. A system of patient benefits was introduced (including one for geriatric care) for patients in private hospitals. The patient benefit did not cover the full cost of care and a patient fee was charged. So a dual system of geriatric long-stay care emerged. People of limited means had the choice of only public hospital beds and had to go on a waiting list until a bed was available. Elderly who had sufficient means to pay the patient fee could enter private hospital and received the patient benefit from the state. This system of dual provision would have been satisfactory if the two sets of elderly using public and private hospital care, had together comprised exactly the group of dependent elderly most in need of long-stay geriatric care. Unfortunately this turned out not to be the case. Several factors may have been responsible. Firstly the (non-income) barriers to entry to each type of care differed. Elderly requesting a public hospital bed had to be assessed by a geriatrician to be in need of geriatric care; access to a private hospital bed was on the recommendation of a general practitioner. Secondly under this dual system of provision the consumer was faced with a non-zero price in public hospital care and a substantial fee in private hospital which many dependent elderly would have been unable or unwilling to pay. Thirdly there is every incentive for private hospitals to keep their beds filled with elderly requesting admission, in order to balance the books, rather than wait until a more dependent elderly person (who can or who is willing to pay the fee) arrives, particularly since the Department of Health subsidy is constant *regardless of level of dependency* and is paid per *occupied* bed day. At any rate, it would have been unlikely if the income distribution of the elderly had matched their need for health care (a point made by Cairns and Snell (1978) against charges for health care). There were two outcomes from this combination of factors.

Firstly there was excess demand for the zero priced public hospital care. Waiting lists for public hospital beds grew longer and there was concern about the number of elderly in acute hospital beds awaiting long-term care (the so-called 'bed-blockers'). In effect this group of elderly were receiving their zero-priced public hospital care but at considerable opportunity cost, since they were displacing people who required acute care.

Secondly a national survey of patients in long-stay care in 1972 found that the patients in private geriatric hospitals were less dependent than those in public (Salmond, 1976). This is an example of the 'image' of the market being more efficient than the public sector versus the 'reality' of the actual market outcomes (as discussed by Culyer, (1982)).

In 1977 the Geriatric Hospital Special Assistance Scheme

(GHSAS) was introduced (Department of Health, 1983). This allowed Hospital Boards to subsidize (by way of a direct charge on the Department of Health) the fees of patients in private geriatric hospitals. Access to this scheme is the same as that for a public hospital bed i.e. assessment by a Hospital Board geriatrician to be in need of geriatric hospital care. This measure improved access to long-stay care for the less well-off. But at the same time patients in private hospitals not in receipt of a GHSAS subsidy were not subject to the same assessment procedures, and still continued to receive the daily patient benefit. There was no incentive under this scheme for Hospital Boards to provide beds within the public system out of their own budgets. It was cheaper (for them) to allow the Health Department (a separate budget) and the patients, (the GHSAS subsidy was means-tested), to bear the cost.

Since that time two important steps have been taken. The total number of public hospital beds and GHSAS beds in private hospital was limited by the bed guidelines per 1,000 elderly. In 1983 the population funding formula was introduced. This linked expenditure on public and private hospital beds, so that the budget for the Hospital Board was reduced, pro rata, for beds provided in the private system. But still, as a legacy of previous policies, the non GHSAS patients in private hospitals receive the daily patient benefit, and state subsidies for private hospital care are still constant, regardless of the level of dependency of the patient. The last piece of legislation was in 1984 when controls on the expansion of private hospitals were introduced. Licences for extra beds may now be refused if sufficient hospital beds are already provided in an area (Department of Health, 1984). Since the state continues to subsidize all licensed beds, this regulation was inevitable. In a situation where the private hospital patients do not pay the full cost of care, the normal market forces limiting supply do not operate. The result is an over-supply of private hospital beds and hence the need for the regulation.

(b) Residential Care

Contemporaneously with the activity regulating hospital care, another set of regulations and funding mechanisms has been introduced for residential care. This will be outlined only in brief, since this research is not addressed specifically to elderly 'at risk' of residential care. The situation at present is that access to private (not religious and welfare operated) rest home care (see section 2.3) is relatively open. There is a (means-tested) subsidy which covers the full fee, and there is no limit on the number of beds.

In contrast, elderly in religious and welfare homes are eligible only for an accommodation benefit, which is insufficient when taken in conjunction with National Superannuation to cover the fee. There is no provision in the population funding formula for residential beds hence the Hospital Boards are hard pressed to fund public residential beds.

The result of these funding mechanisms is that elderly find it relatively easy to enter the first level of institutional care (the rest home). There is an argument that this creates demand further up the 'continuum of care' i.e. geriatric care. Certainly if an elderly person in a rest home became 'too dependent' (s)he would be unlikely to return to the community; whereas if (s)he had not entered the rest home, the possibility would have existed of staying on at home with extra services.

One second feature of the marketplace for geriatric care relates to the religious and welfare organizations. Under the current system of funding, there is no incentive to keep elderly in this form of residential care if they become more dependent, (i.e. by providing additional care).[2] Therefore this too may increase the demand for geriatric care.

(c) Community Care

The last product which the state funds is community care though the level of involvement in terms of the whole product is low. The main activity of the state is with community support services. Some services are provided free, for others a fee is charged. Public purses involved are many: Hospital Boards, Departments of Health and Social Welfare. The organization and provision varies throughout the country but usually there is a separate budget and separate assessment for each service. The administrative structure is complicated and many organizations (public and private) are involved in the delivery of community services.

Keeping track of individuals and of the community services each receives, an essential pre-requisite of a community care program is not easy. Costing each service, identifying the cost of all services received by an individual is no less

---

2 Campbell Shelton Caradoc-Davies and Fanning (1984) found that rest home residents were more dependent than residents of religious and welfare residential homes, consistent with the ease or difficulty of obtaining funding for each type of home. Perversely a survey of another area of New Zealand (Sainsbury, Fox and Shelton, 1986) found that residents in private rest homes were not significantly more dependent than those in Religious and Welfare Homes in spite of funding being more easily available. This is another example of the 'reality' versus the 'image' of the market as discussed by Culyer (1982).

difficult. Under the system of separate budgets for each community service, it is difficult to transfer funds between services, so that a new user or an existing user with new needs, can be supplied with the required set of services. In short, the process of ensuring an appropriate allocation of services between clients is more difficult than it need be.

3.1.3 Difficulties of Providing the Appropriate Balance of Care

One further concern of the state is with providing the correct 'balance of care' i.e. number of places of each type of care. This is a function of, among other things, the dependency of the population, the effectiveness of each type of care and what the country can afford. Under the system of separate funding for each type of care it is difficult to adjust the balance in a particular region either by altering the mix of services provided or by providing a new service, since all[3] state funds 'saved' by offering less of one mode of care cannot always be transferred to other modes of care. Moreover the differential interventions for each mode of care interfere with the relationship between the suppliers of a particular mode of a care and elderly who might benefit from it. Services are provided where funds are available. Rather than a smooth transition between modes of care, there are bottlenecks where price to the elderly is zero and the resulting allocation of resources is spurious.

'Balance of Care' is a global issue i.e. it encompasses all types of care be they community or institutional, publicly

---

3 Hospital Board funds can be transferred from one service to another, but these monies do not comprise all state expenditure on all services for the elderly.

or privately provided. Private sector providers are concerned with local rather than global matters. Each private operation is interested in its own efficiency and effectiveness.

For example private hospitals are concerned with efficient and effective *hospital* care. They are not concerned with global effectiveness i.e. whether community care would be more effective for some of their patients, nor with global efficiency i.e. whether more elderly could be 'served' by a mix of community and institutional care, nor with equity i.e. whether elderly have differential access to services.

Questions as to the appropriateness of the allocation of all resources between groups of elderly people i.e. whether the available services and facilities are being consumed by the 'correct' groups of elderly, are outside the sphere of operation of the private hospitals, except in so far as they relate to their own sector.

This self-interest is of course the foundation of competitive markets. But allowing the market for private hospital care to operate freely would result in an allocation of care to elderly people that society would not accept e.g. some dependent elderly would not have access to care. Therefore there is a need for state intervention, which involves affecting the quantity of care or the price. The first is achieved by regulating the number of beds; the second by a system of subsidies, since the price dictates where care takes place. But the existing interventions distort the price signals. For example the state subsidizes less dependent patients in private hospital to the same extent as very dependent patients and continues to subsidize (but regulate the number of) patients who have not necessarily satisfied the state's criteria for access to long-stay care. This has led to a spurious allocation of resources. A balanced set of regulations are needed to ensure the appropriate flow of resources to elderly people takes place.

3.1.4 Effect of Current System on the Consumer

(a) Costs and Benefits to the Consumer

The direct consumers of care of the elderly are of course the elderly themselves. But since the immediate families of the elderly are affected by the choice of care they will also be considered in this section.

From the consumer point of view each option for care has its own set of costs and benefits. The choice between public and private hospital care will have different cost implications. Even if a subsidized private hospital bed is obtained, some part of medical care must still be paid for[4] in private hospital. There is no information on the relative benefits to the elderly between private and public hospital care in terms of morbidity, mortality or quality of life. The general assumption is that they are similar. From the consumer's point of view community and institutional care vary both in terms of costs and benefits. In the community, not all community services are free and though for most elderly the expenditure on living and disability related services would be less than the fee for a private hospital bed (or National Superannuation, which would have to be forfeited in public hospital care) there are some elderly who are so dependent that the purchase of services (e.g. private

---

4 G.P. consultations for long-stay hospital patients are subject to the same state subsidy as those for elderly people living at home. A fee may be charged.

nursing) could exceed the costs they would face in hospital care.

The fact is of course that much care in the community is not purchased but is provided by families and other 'informal' carers so that a major difference in cost between home and hospital care is in the cost of providing this informal care.

The full spectrum of benefits of home care relative to institutional care have not been formally measured in New Zealand. One of the benefits of home care i.e. that it is the elderly's preference has been identified (Scotts, 1979) and it has been established that there are some satisfying aspects for the carer (as well as problems) in their role (Koopman-Boyden and Wells, 1979). The benefits of hospital care are in terms of the higher level of measurable resources e.g. professional care from nurses and therapists.

(b) Difficulties of the Current System for the Consumer

The elderly is concerned with being able to obtain appropriate care as (s)he requires it i.e. with increasing dependency. The differential funding for private rest and residential home care has already been discussed. The effect on the elderly is that (s)he would find it difficult to move from rest to residential care, even though residential homes are well placed, on account of their access to trained staff, to care for patients of a higher level of dependency. Secondly the cost, to the elderly, of (Religious and Welfare) residential care could be similar to the cost of private hospital care and would exceed public hospital care (which is free). Finally and perhaps most important, since it is the elderly's preferred choice, when considering the community care option, the community support services are so limited that frail elderly find it harder to get access to these small resources than to enter rest homes, and the very dependent elderly requiring hospital care can access considerable hospital resources more easily than obtaining extra care in the community.

The question of rehabilitation has not been dealt with, but if long-stay rest homes or hospitals provided care which restored some patient functions, there is little financial incentive and considerable disincentive to returning home, since state monies 'saved' by so doing cannot be converted into resources in the community.

3.2 PROBLEMS WHICH NEED TO BE ADDRESSED

The history of the state's activity in the care of the elderly provides an example of the inevitability of state regulations in the provision of health care (as discussed by Maynard, (1982)). The state has however influenced the behaviour of the private sector in an ad hoc way, piecemeal by sector, without viewing the system as a whole and without taking into account the interrelationships between the sectors.

3.2.1 Lack of Information for Planning

The present situation is of a dual system of geriatric care with price rationing in the private sector and waiting list rationing in the public sector. As the elderly population increases, the state has the choice within hospital care provision of providing more public hospital beds or subsidizing more private hospital beds. Yet there is little information on the relative efficiency or effectiveness of the two forms of care.

The current provision of community care is uneven over the country. Community care is not organized or funded in ways that enable the level of resource usage and the costs for individual elderly to be easily estimated, and the benefits have not been measured, hence efficiency and effectiveness cannot be determined.

Some research has been undertaken on the type of elderly in each form of care (e.g. Salmond (1976), Scotts (1979), King Fletcher and Main (1985)), and inappropriate allocation has been identified, but there is little information on the costs or benefits to the state or the elderly if the mix of care offered, or the allocation of elderly to type of care, were to be changed.

3.2.2 Information Required to Compare Modes of Care

The issues which are under debate at present are whether private hospital care is more efficient than public hospital care and whether community care is better (more effective) and cheaper than hospital care.

This begs the question "more efficient" - at what, and "better" - at what. The data available suggest that private hospital care is cheaper than public hospital care (Ward and Daldy, 1982). This data relates *to those patients in private hospital care* and to the care they receive. But what is the product? Patients in private hospital are less dependent on average than those in public hospital (Salmond, (1976), Campbell Shelton Caradoc-Davies and Fanning (1984), Sainsbury, Fox and Shelton (1986)), so it is not sufficient to use raw cost data for comparison purposes. Ward and Daldy identified the higher staffing levels in public hospital. To what extent are the lower costs in private hospital due to the lower average dependency of their patients and to what extent due to efficiencies? The first requirement is for information on the care received and the associated costs of that care for patients at a *specified level of dependency* in both public and private hospital care. Until the 'businesses' of the private and public hospitals are explored and some model determined to 'correct' for differences in the products (in terms of dependency of patients) then the question of private versus public hospital efficiency cannot be addressed.

In the same way comparisons between community and hospital care are difficult to make since the dependent elderly typically in community care are on average less dependent than those in hospital care. This is particularly important for elderly 'at the margin' of home and hospital care since they are most likely to be affected by any change in policy which might follow from an analysis of costs. Savings by keeping such an 'at the margin' person in the community rather than hospital would be less than anticipated since the cost in hospital would be lower than average hospital costs yet the cost in the community would be higher than average community costs (Rayner and Green, 1984). There is thus a need to estimate costs related to the dependency of the elderly in each mode of care.

A further difficulty is that community care shifts a large part of the costs to the carer. Comparing only the costs to the state of community and hospital care leads to the trivial result that community care is cheaper, but the real issue is whether carers will continue to contribute their unpaid input so that community care remains an option. The process of community care needs to be described i.e. the levels of inputs from all sources need to be measured so that the comparison of costs is comprehensive i.e. includes all costs. The question of efficiency can then be considered.

3.2.3 Strategic Uses of Information

Whatever the outcome of the public v private hospital efficiency debate some fundamental questions remain i.e. how to develop and deliver effective hospital care, how to determine for which group of elderly this form of care is most effective and how to ensure that the 'correct' elderly have access to this care. Information on the process of public and private hospital care, and the development of methods to compare their relative efficiencies provides a useful base for these other issues to be addressed.

With respect to the community versus institutional care debate, this is a more global question and relates to the wider question of effectiveness of relative programs of care. Information on exactly what constitutes community care (the process), what the current allocation of community care resources to individual elderly actually is, and what the full costs are, enables an assessment to begin of how good a product community care is, and what improvements could be made in its delivery and allocation. Comparisons between the resource usages in home and hospital care for elderly of comparable dependency, provide information which is essential when considering a change in policy with respect to the 'balance of care' between the community and institution.

3.3 CONTEXT OF THE RESEARCH

The research to be presented follows two lines of enquiry. Firstly in order to compare the relative efficiency of the private and public hospitals, the 'business' of each type of hospital is investigated i.e. the type of patients cared for and the care given. Models are developed relating costs to patient disabilities. The costs of each type of hospital care are then compared taking into account the different nature of the businesses (dependencies of the patients). Benefits of each type of hospital care, other than in terms of the measurable resources consumed, are not considered, hence the comparison of costs between public and private hospital care can be considered to be a cost-effectiveness analysis from which statements can be made about efficiency within the hospital care sector. Nonetheless, since some tangible benefits of each type of hospital care are considered the analysis is directed towards a cost-benefit analysis approach.

The second enquiry involves a comparison of community and institutional care. Again a cost measurement exercise is undertaken to estimate what is put into each form of care, and some tangible benefits are also measured and compared.

Informal care in the community is measured to give a complete picture of the cost of care. The cost of care is again related to the dependency of the elderly so that the costs and resource consumption in home and hospital care of elderly with specific disabilities can be compared.

In the next chapter the costs of each form of care are identified and methods of measurement are described.

CHAPTER 4

METHODOLOGY OF COSTING EACH MODE OF CARE

CONTENTS PAGE

4.1	INPUTS TO CARE	44
	4.1.1 Hotel Care	45
	4.1.2 Personal Care	47
	4.1.3 Supervision	48
	4.1.4 Medical Care	48
	4.1.5 Therapy Care	49
	4.1.6 Social and Recreational Services	49
	4.1.7 Personal Living Resources	50
4.2	APPROACHES TO COST ESTIMATION	50
	4.2.1 Expenditure Approach	51
	4.2.2 Resource Cost Approach	53
4.3	COST ESTIMATION FOR INDIVIDUAL ELDERLY	54
4.4	COST ESTIMATION FOR EACH COMPONENT OF CARE	55
	4.4.1 Hotel Costs	55
	4.4.2 Personal Care Costs	59
	4.4.3 Supervision Costs	60
	4.4.4 Medical Care Costs	61
	4.4.5 Therapy Costs	61
4.5	HOW COSTS ARE SHARED	62
4.6	SUMMARY	62

CHAPTER 4

METHODOLOGY OF COSTING EACH MODE OF CARE

Before any attempt can be made to compare the costs of care in different environments, some basis must be established for the comparison. This is the subject of this chapter. The purpose is twofold: first to provide a framework for a critique of other work on the estimation of costs and on cost comparisons (Chapter 5) and secondly to lay down the foundations for the cost estimation methods which are used in Chapters 8 - 11 in an empirical study of care of the elderly in New Zealand.

The argument will proceed by identifying the resources required for care of the dependent elderly. This will be followed by a discussion of different concepts of cost when providing these resources. Finally various methods by which these costs can be estimated, will be discussed.

Since the objective of the cost estimation in each mode of care is to determine how costs are related to patient dependency, attention will be given to identifying which resources are consumed equally by all elderly people in a particular mode of care, and which vary according to the level of dependency.

4.1 INPUTS TO CARE

Care of the dependent elderly at home or in hospital involves the consumption of various resources. Some of these resources are essential to sustain life; some alleviate discomfort; others enhance the quality of life. Some will be provided regardless of the dependency or incapacity of the elderly person; others depend on characteristics of the patients such as their level of disability.

The level and type of resources provided in each mode of care may differ. In order that the comparison of cost between modes of care is comprehensive *all* inputs to care must be included in the cost estimation.

In this section, the resources provided in each mode of care will be enumerated, and the way they are provided (how and by whom) will be described. The resources will be grouped into the type of care given.

4.1.1 'Hotel' Care

Resources grouped under hotel care are the goods and services involved in providing accommodation. It is helpful to separate out hotel costs from other costs since the former are unlikely to differ substantially between individual patients. Hotel care may be considered in two parts: capital assets, and supplies and services associated with accommodation.

(a) Capital Assets

This includes land, buildings, furnishings and equipment. In the case of institutional care, the accommodation is owned by the state, a religious or welfare organization or a private proprietor. Certain facilities are specific to individual elderly e.g. a bedroom, others are shared e.g. dining, recreational areas. The share of accommodation to each elderly person within a particular institution can be assumed to be similar. (Patients may have differential uses of some equipment e.g. wheelchairs). Considerable scope exists for variation between institutions with respect to the quality of accommodation provided.

In the community, the dwelling may be owned (or rented) by the elderly person, family or friends. The elderly person may live alone or with others. The share of the accommodation to the elderly person will depend upon the number of people in the household and the usage characteristics of the house e.g. a special part of the house may be designated for the sole use of the elderly person. A variety of accommodation may be utilized by the elderly from small pensioner flats to spacious or luxurious houses.

(b) Hotel Services

The hotel services are catering, laundry, cleaning, maintenance, insurance, heating, lighting, telephone and administration.

In hospital various paid staff are responsible for providing these services. The consumption of catering and laundry services may vary between individual elderly on account of special diet needs in the first case, and level of incontinence in the second. The consumption of the other hotel services would be very similar for elderly within a particular hospital. There would be variation between institutions on account of differences in the standard of hotel services (e.g. food, cleanliness etc.).

In the home situation, there are several sources of hotel services: formal agencies (e.g. meals-on-wheels), privately hired help and assistance from family and friends. The elderly themselves may also contribute e.g. with light housework. Standards will differ between households with respect to the quality of food etc. Hence the type, level and source of hotel services resources consumed in the community will vary between individual elderly.

4.1.2 Personal Care

Personal care refers to assistance with bathing, dressing, washing, toileting, eating, moving and any other necessary tasks associated with a person's personal care. These tasks have been grouped together since it is disability in these areas which defines the target population in this research. Fit elderly people attend to their own personal care; substantial disability in personal care tasks is the main criterion for being assessed to be in need of geriatric hospital care.

In an institution, this type of care would be carried out by nursing staff. The amount of nursing resources consumed would vary according to the dependency of the patient. The standard of nursing care would be the same within a hospital (with respect to bathing and toileting procedures) therefore the consumption of nursing resources would reflect patient dependency. But the standard of nursing care between institutions could be expected to vary (being a function of the level of funding, the efficiency, the availability of nursing staff etc.) so that the comparison of the usage of nursing resources between hospitals would reflect these factors as well as the dependency of the patients.

In the home situation, personal care is provided by visiting home nurses, family members or by paid private help. Consumption of these resources varies between individual elderly not only on account of the level of disability but also because of the different standards of care between elderly. Therefore a relationship between resource use and disability may be clouded by these other effects.

4.1.3 Supervision

Dependent elderly people may require access to care for periods longer than are necessary to perform care tasks. Supervision may be required continuously or at intervals, to ensure the elderly person has no further need for help and has come to no harm. In some cases it is sufficient to provide a means for the elderly person to communicate their need.

In hospital trained staff are on duty 24 hours a day and regular ward rounds are made to check if patients require assistance. This continuous supervision is provided to all patients even though some could manage at a lower level of provision.

At home, members of the elderly's family (assisted by sitters) may also provide continuous supervision, living with the elderly person in order to be at hand. But a spectrum of provision is possible. Night supervision (with the help of night sitters) would be provided in only a small proportion of cases, most elderly being able to manage with access to someone in the household but asleep. Sometimes the elderly person can be left unattended for a few hours in the day. Checks can be conducted by telephone. Access to care may be by means of an alarm. Hence the provision of supervision in the home situation is more closely linked to the dependency of the elderly than is supervision in hospital.

4.1.4 Medical Care

Elderly people, both at home and in long-stay hospital care, utilize medical services and goods. The medical care may be divided into two parts: the ongoing care to treat or ameliorate chronic conditions, and the care for acute medical problems.

In public hospital, ongoing medical care is provided by hospital doctors; treatment programs may be administered by nurses. In private hospital and in the community, ongoing medical care is provided by general practitioners. Family members may ensure treatment programs are followed. Other resources used are medications and dressings.

In each mode of care, referrals to specialists for consultation about acute problems, may take place. Treatment may be at a general hospital (e.g. surgery). As was stated in Chapter 1 the consumption of resources associated with this acute care do not fall within the bounds of this study.

The level of ongoing medical care depends upon the health of the individual. The state of health may not always be related to dependency. For example a stroke victim may be very disabled but require little medical care. In each mode of care the consumption of medical care resources will vary between individual elderly and may also vary from month to month for each individual.

4.1.5 Therapy Care

Therapy care is defined as that provided by trained personnel e.g. physiotherapy and occupational therapy. These personnel are available in both public and private hospitals. The level of use of the services would vary between individual elderly. In the home situation, home therapists treat individual elderly people who are referred to them.

4.1.6 Social and Recreational Services

In addition to food, accommodation and other 'essentials' of life, some recreational opportunities and social inputs are provided in each form of care. In hospital care, volunteers offer these services. In addition there is some recreational contact in the programs of activities organized by occupational therapists (see 4.1.5 above). In the community similar facilities are provided by recreational and craft clubs. Family members and friends provide an important social input in the community and (by visiting) in hospital.

The level of consumption of these resources is likely to vary substantially in the community and to a less extent in hospital. This will be due to the personality and preferences of the individual elderly person (and the family). Including the costs of these inputs would cloud the relationship between total cost and disability. For this reason the costs of these resources are not included in this thesis. The level of these resources may be considered as indicators of the benefits of each type of care.

4.1.7 Personal Living Resource

These include clothing, toiletries and other personal items. The consumption of such resources would very likely vary between individual elderly, but on account of factors such as income etc. and not necessarily disability. The costs of these resources are not included in this thesis. It is assumed that they could be similar (for an individual patient) in each mode of care.[1]

4.2 APPROACHES TO COST ESTIMATION

In the previous section, the resources consumed in each mode of care were identified. The problem now is to estimate the costs of providing these resources. The objective of the

---

1 It is likely that the cost of these resources would be lower in hospital than at home, since there is usually limited space in institutions. Having access to a variety of personal items could be considered a benefit of home care.

cost estimation is to identify the cost to all sectors of society, of elderly people with specific disabilities in each mode of care. Two approaches will be considered, the expenditure approach and the resource cost approach.

4.2.1 Expenditure Approach

The easiest approach is to use expenditure to estimate costs. Information is collected on payments made when resources are provided or consumed. For hospital care, there are usually difficulties associated with isolating expenditure for particular groups like the elderly from total expenditure, owing to the limitations of the accounting systems particularly where resources are shared with other groups of patients. If a reasonable estimate of total expenditure is obtained there is still the problem of how to allocate expenditure to individual patients i.e. whether to use average costs or marginal costs. In the home situation a similar problem arises when trying to separate out expenditure for the elderly from that of the family. This problem will be discussed in the next section. Even if precise estimates of expenditure on each resource for each individual could be obtained, the resulting cost estimates would be unsatisfactory on account of the deficiencies of the expenditure approach to cost estimation.

For many resource transactions, no payments are made. One example of this is the informal care in the community i.e. the provision of unpaid help to elderly by their family and friends, e.g. cooking, cleaning, etc. This represents a substantial contribution of time (Koopman-Boyden and Wells, 1979) and it has frequently been acknowledged as an important source of help for elderly living at home (e.g. Chetwynd, 1983, Bennett and Wallace, 1983) yet the expenditure approach to cost ignores it completely. Some services, for example meals-on-wheels depend upon unpaid volunteer help, hence expenditure on such services underestimates the full cost of providing the resources. These unpaid labour inputs are not 'free'. Something else other than money (usually time) has been forfeited so that the resource can be provided.

A second example of resource use where no money flows is capital assets e.g. land and property, which are fully owned. If the property is rented, the rent may be used to estimate the cost, but hospitals are not usually rented, and very few elderly live in rented homes in New Zealand. If there are outstanding loans on a property then the loan re-payments will be included in expenditure, but these may not properly represent the cost of providing the assets in a given year.

Expenditure does not measure the full resource costs to the economy and is therefore not an appropriate approach to use for cost estimation in order to explore economic efficiency, which is concerned with total output for *total* input. Using a public finance approach to costing (as some research has done) i.e. confining the costs to government expenditure is even more restrictive. This ignores the expenditure of other sectors of society as well as non-monetary costs to all sectors.

Cost estimates based on the expenditure approach must be used with caution. Conclusions based on such estimates may have in-built assumptions, the validity of which needs to be checked. For example home care may be found to be cheaper (in these terms) than hospital care and hence a policy change made in favour of home care. But this assumes that the unit costs in the expanded system of community care would remain the same as estimated i.e. informal and volunteer help will be provided for more elderly. This would not necessarily be the case. Similarly if hospital care were to be expanded so that a new hospital were to be provided some realistic allowance would have to be made for the cost of the capital assets required.

4.2.2 Resource Cost Approach

The resource cost approach to estimation recognizes the cost of resources for which no cash payments are made. A cost or value is imputed to the provision of the resource. One way of doing this is to use the 'opportunity' cost which is defined as the value of the next available use of the resource if it had not been used for the present purpose i.e. care of the elderly. It is the value foregone by using the resource in one way rather than another. In the case of informal care, the opportunity cost is the value to the informal carer of the time given to the care of the elderly. This value will depend upon the alternative use of that time. Hence it could be the value of leisure or the value of paid employment. These values are difficult to estimate.

Even if all carers were prevented from employment by caring for the elderly (and there is no evidence that this is the case) the value of that employment may not be assumed to be equal to the lost income. As Culyer (1976) points out wages are (in part) a compensation for working so the value of employment to the worker is less than the income from it.

In the case of the cost of capital, the opportunity cost is the value foregone by investing money in assets for care of the elderly rather than in other projects.

Opportunity cost is dependent upon who is providing the resources and their (other) options. It is a useful vehicle to describe the current situation. It reflects what society foregoes in order to provide care of the elderly. But the current means of provision may not be the most efficient. Another approach to estimating resource cost is to use the cost of the alternative means of provision. For example in costing informal care, the cost of hired labour could be used. This has the intuitive interpretation that it is the amount 'saved' by informal carer help and it is useful for planning purposes in that it provides estimates of the cost of expanding services.

4.3 COST ESTIMATION FOR INDIVIDUAL ELDERLY

Whichever cost approach is used, the problem remains of how to estimate the cost for individual elderly, particularly for hospital care where cost data relates to a group of elderly. The cost required is the marginal cost of each resource for an individual patient. For some resources the average cost may be used to estimate the marginal cost. The validity of this depends upon the variability of use between elderly of the resource in question, and the relative contribution of the cost of that resource to total cost.

If the use of a resource is very similar for each patient then the average cost may be used for the cost for individual patients. If the use of a resource is variable between patients and if that resource accounts for a substantial proportion of total cost then the marginal cost should be used, since the variation in the resource use will result in significant variation in the total cost for individual patients. In order to estimate marginal costs, information needs to be collected on resource use by individual patients, and the unit costs of providing the resource need to be estimated.

There are some resources for which the use is variable but the resource represents only a small part of total cost. The decision between marginal cost and average cost depends upon the level of accuracy required in the results (i.e. what proportion of the total variation in cost between individual patients we wish to explain) compared to the cost of obtaining the necessary data.

The estimation of capital cost poses a problem, since capital is a fixed cost and the marginal cost for an individual patient is zero. But buildings, land etc. are part of the total resource provision for care of the elderly and the purpose of this research is to estimate the full cost i.e. of all resources, hence the marginal cost is inappropriate. The cost of capital will therefore be treated as if it were a variable cost and the cost for an individual elderly person will be estimated in proportion to the use of the resource.

4.4 COST ESTIMATION FOR EACH COMPONENT OF CARE

In this section each of the resources described in 4.1 will be considered and methods of costing to be used in the research will be selected.

4.4.1 Hotel Costs

(a) Capital Assets

As discussed in section 4.2.1, expenditure in any year on capital assets is 'lumpy' and may not properly reflect the cost of the resources consumed in that year. An alternative approach is to spread the capital cost over the expected life of the assets to obtain a yearly cost. The problem is to select an appropriate estimate of the cost of the accommodation. Using the original purchase price as an estimate does not reflect the current value of the asset because of the combined effects over time of depreciation of the real value of the asset and inflation in building costs. In addition it is not relevant to the costs of providing new facilities. The current market value or the replacement cost are more relevant estimates of the value of an asset.

The market value is useful to value resources already provided; the replacement cost, which is probably higher, is appropriate when estimating the costs of expanding or setting up facilities, particularly when there is no ready market to supply suitable buildings for expansion e.g. for hospitals. In either case the capital value, V, may be amortized over the life of an asset, n, using an appropriate interest rate, i, to give an annual equivalent, $a_{\underline{/n}i}$ calculated from:

$$a_{\underline{/ni}} = \frac{V\left(1 - \frac{1}{1+i}\right)(1+i)}{\left\{1 - \left(\frac{1}{1+i}\right)^n\right\}}$$

This gives a closer estimate of the resource cost of capital. As $n \to \infty$, $a_{\underline{/n}\,i} \to i\,V$, which, if i were the interest rate of an alternative investment, would represent the opportunity cost of the capital tied up in the asset.

The interest rate used in the calculation of $a_{\underline{/ni}}$ measures the rate at which future costs may be substituted for present costs. The interest rate used by the Department of Health in evaluating health care projects is 10 percent. This will be used in the cost estimations. Estimates will also be calculated based on an interest rate of five percent to test the sensitivity of the results.

The choice of n depends upon the assets in question. Land has an infinite life and is valued in perpetuity. The annual equivalent cost of land with a value V will be iV. The expected life of new hospital buildings is 60 years and this value of n will be used for both hospitals and private homes. The life of existing property will of course vary. A value of n equal to 40 will be used. But in fact the annual equivalent converges rapidly for values of n over 40 and it makes very little difference what value of n is used.

The expected life of furnishings and equipment varies from weeks for crockery through to several years for hard furniture. The expected life of new equipment will be taken at 15 years and existing equipment at 10 years.

The sum of the annual equivalents for land, buildings, and furniture may be used to estimate the cost per year for individual elderly. As was discussed in section 4.3 the costs of capital will be treated as if they were variable costs. In hospital care, it may be assumed that each patient shares equally in these resources hence the cost per year for an individual patient is the simple average of the total annual equivalents, over all patients. In the community the simple average (over the number of people in the household) may underestimate the resource cost if the elderly person occupies a disproportionate share of the house. The marginal cost would be more appropriate. This reflects the cost of the resource the elderly is using and measures the opportunity cost i.e. of a house (or part of a house) available for the use of others. Both average and marginal costs are considered in Chapter 10 on the costs of care in the community.

(b) Hotel Services

The cost of hotel services in hospital can be estimated from operating costs, obtainable from annual accounts. There may be difficulties in obtaining estimates of costs for a particular hospital or for elderly people within a hospital. Assumptions need to be made about the consumption of resources by the elderly, compared to other patients. These problems, and how to overcome them, will be discussed in Chapters 8 and 9, on the costing of public and private hospital care.

The cost of hotel services for individual elderly may be estimated by the average cost per patient if it can be assumed that usage is similar for each patient. Procedures for dealing with services where this is not so will be discussed in the actual cost estimation.

In the home situation there are several components to the cost of hotel services: household expenditure on 'ordinary' hotel services, the cost of unpaid labour (informal help) in their provision and the cost of supplementary hotel services (formal help) provided by agencies on account of the disability of the elderly. Household expenditure on 'ordinary' hotel services will vary between households, but not necessarily because of dependency differences in the elderly. Costs not related to dependency will be estimated by average costs for elderly people living at home. Costs which may be related to dependency (e.g. heating) are treated separately. In apportioning these costs between the dependent elderly and others in a household, both the marginal cost and the average cost are calculated. The marginal cost is used in the analysis.

The consumption of both formal and informally provided hotel services by elderly in the community may vary between elderly on account of the level of dependency, hence the cost of these services will be estimated by marginal costs i.e. the estimates will be of the cost of providing the services actually received by elderly people. Information must therefore be collected on such help and services. The cost of informal care will be estimated by both the value of employment foregone and the alternative cost of hired labour. Since the level of informal care depends on factors other than disability i.e. standards of carer, efficiency of carer, etc., estimates of the alternative cost of hired labour will be based on specified task frequencies and standard task times (see section 10.7.1).

4.4.2 Personal Care Costs

Personal care, as defined in 4.1, is performed by nursing staff in hospital so that the cost of this care may be estimated from the amount spent on nursing salaries, which can be obtained from annual accounts. Not all a nurse's time is spent on personal care, however. Time is also spent on administration, supervision and domestic activities. The proportion of the nursing workload spent on these duties may vary between hospitals but it is likely to be at least 50 percent (Rhys Hearn, 1983). Some procedure is required to separate out the cost of personal care so that a cost per hour can be estimated. This will be discussed in Chapters 8 and 9.

Nursing salaries account for a major part of the cost of geriatric care. In addition personal care is likely to vary between patients on account of disability. Therefore the cost of personal care will make a significant contribution to the variation in the total cost of care for individual elderly. Therefore data must be collected on the consumption of this resource by individual patients. This is described in Chapter 7. The cost of personal care for individual patients can then be estimated.

In the home situation information must again be collected on the consumption of personal care, this time from *all* sources (i.e. family, home nurse etc.). Unit costs of provision must be estimated for each source. In the case of formal services, this will be performed by analysing the costs of each service and the total provision of each service over a year (see section 10.5). In order to cost informal care, a similar procedure will be used as for costing informally provided hotel services i.e. the costs will be based on standard task times and alternative wage rates. The frequency of tasks will be that reported by the carers.

4.4.3 Supervision Costs

This is a very difficult cost to estimate. In an institution, supervision is available to one patient whilst a care task is being performed for another i.e. a joint product effect, so that the marginal cost of supervision is zero. Moreover a number of patients can 'use' the resource 'supervision' simultaneously, so that the average cost is very small. Patients may vary in the need for supervision so there is an argument for dividing up the cost according to the 'need' pattern. This marginal cost approach, and also the average cost approach are discussed in Chapter 8.

In the home situation supervision may be a very expensive commodity to supply, necessitating the carer remaining within the household for long periods of time, free to persue her own interests but not to leave the home. The approach taken to costing the supervision at home, is to base the cost on the provision of some conceptual relief time for the carer. This is discussed in Chapter 10 (section 10.7.4).

4.4.4 Medical Care Costs

Although the usage of medical goods and services on account of chronic[2] conditions and disabilities varies between individual elderly, the cost of this care represents only a small part of the total cost. Hence substantial variation in the cost of this care would produce much less variation in the total cost of care. Therefore average costs per patient are used unless data is readily available on resource use for individual elderly. The cost of doctor time in hospital was estimated by the average costs, but in the community, the costs for individual elderly were estimated. The cost of pharmaceuticals was estimated by an average cost in each mode of care.

4.4.5 Therapy Costs

The cost of therapy in care of the elderly is less than the cost of medical care. Therefore once again, even though the therapy costs varied between elderly, the average cost was used unless data could be easily obtained on the cost for

---

2 As was stated in Chapter 1, the costs of acute medical care are not included in this research.

individuals.

4.5 HOW COSTS ARE SHARED

The objective of the cost estimations just described, is to estimate the total cost to society of providing the resources for the care of the elderly in each mode of care. But as important as establishing the total cost, is the question of how these costs are shared by the state, the family, the elderly and the volunteers. It is the relative shares of the resource 'bill' to the various contributors which influence their behaviour. Therefore in the costing of care in Chapters 8 - 11 the share of the cost to each sector will be identified.

4.6 SUMMARY

The inputs to each mode of care for the elderly have been identified and ways of costing them, outlined. In order to estimate the total costs of care, the cost of unpaid informal carer help is included. Chapter 5 discusses previous research on the costing of care of the elderly.

The objective is also to determine costs which reflect the actual resource use by individual patients. Therefore information was required on the actual use by individual elderly of those resources likely to be responsible for significant variation in total cost. Two criteria were set up to identify such resources. Usage had to vary significantly between individuals, and the cost of the resource had to be a substantial proportion of total cost. Personal care satisfied both these criteria. Therefore a data collection was necessary on the consumption of personal care. Chapter

6 discusses previous research on how resource use and costs are related to disability. Chapter 7 describes the collection of data on nursing care and disability, which is used in the research.

CHAPTER 5

PREVIOUS RESEARCH ON COSTS OF CARE OF THE ELDERLY

CONTENTS

	CONTENTS	PAGE
5.1	INTRODUCTION	64
5.2	COMPARATIVE COSTS OF ALTERNATIVE MODES OF CARE	64
5.3	COSTS OF COMMUNITY CARE	72
5.4	DISABILITY-RELATED HOSPITAL COSTS	75
5.5	NEW ZEALAND STUDIES	76
5.6	SUMMARY	78

CHAPTER 5

PREVIOUS RESEARCH ON COSTS OF CARE OF THE ELDERLY

5.1 INTRODUCTION

There has been a great deal written about the need for research into the costs of caring for the dependent elderly. In addition there have been many empirical studies on this problem. A detailed review of 17 such studies may be found in Daldy (1982). The objective of this chapter is not to review in detail every piece of research. Rather it is to critically discuss a selection of studies which represent the types of costing which have been undertaken, to consider the main findings of the research and the deficiencies in the approaches used. Studies which have influenced the approach to costing used in this thesis will be given particular emphasis.

The material is organized into sections according to the modes of care being costed, although many studies of one mode of care make some reference to the cost in another. The order of material reflects the developments over time of the research. New Zealand research is considered in a separate section. Many of these studies develop methods of measuring the level of disability of the elderly or rely upon classification systems developed by others. A discussion of ways to measure disability is deferred until Chapter 6.

5.2 COMPARATIVE COSTS OF ALTERNATIVE MODES OF CARE

A detailed and extensive study of elderly people in the community on a waiting list for residential care, by Wager (1972) has been the baseline for much research in the United Kingdom. A classification of incapacity was developed.

Information was obtained on help received from agencies and families. The costs of community care and residential care were estimated, which included the cost of housing.

The study compared the average cost of care at home, under various living conditions with the average cost of residential care. The cost differential was compared to the cost of extra home services recommended by social workers as being necessary to maintain the elderly in the community. The conclusion was that increasing community support services was a cost-effective strategy.

The research did not include the cost of informal care, hence the conclusion may not necessarily be valid from the total resource provision point of view i.e. it is possible that the full cost of community care (including informal care) required to maintain the elderly at home could exceed the cost of residential care. Moreover, the cost estimate used for residential care for each person was the average cost and was not related to the person's dependency. The actual cost of residential care for some of the elderly people in the sample could have been less than the average cost and hence the cost advantage of home care over residential care would have been less than estimated.

Research by Mooney (1978) used a similar approach to that of Wager in a survey of elderly in residential homes and the community. The cost comparison between the modes of care was based on the costs of 'marginal' populations i.e. those who could be cared for in another mode of care. It was recognized that the cost for these elderly may differ from the average cost taken over all elderly in a particular mode of care. Health Visitors identified elderly people in the community whom they considered to be at the margin of hospital or residential home care. Matrons in residential homes classified their residents in a similar fashion. The marginal and non-marginal populations in a particular mode of care were found to be significantly different on several measures of disability. A discriminant analysis using mobility and housing situation was used to classify elderly people in the community into marginal and non-marginal groups. Two-thirds of those elderly identified by health services personnel as being marginal were also predicted to be marginal by this model.

In the cost estimation, the same (average) cost was used for hospital care and for patients at the margin of hospital care. Residential care costs were estimated separately for marginal and non-marginal groups, as were the costs in the community, but the same cost was used for all elderly within a particular marginal group in the residential homes (e.g. at the margin of community care). The cost of family help in the community was not estimated.

The author then compared similar populations e.g. the costs of residential-home-margin elderly who were living in the community with the costs of community-margin elderly who were in residential homes. The conclusion was that home care is less costly than residential care and hospital care for groups of elderly at the appropriate margins. Similarly residential home care is less costly than hospital care for the group-as-a-whole of hospital-margin elderly in residential care. The author noted that the costs for some individual elderly could violate these conclusions i.e. the cost in a lower level of care could exceed the cost in the higher level of care. Since the cost of informal care was not included in the cost estimation, this possibility is strengthened when comparing the costs of community care with other forms of care. Moreover it is possible that elderly living in the community or residential care but at the margin of hospital care may not have been as costly to care for in hospital as the average hospital patient, therefore the cost difference between hospital care and other forms of care may be less than was estimated.

A more recent study by Wright, Cairns and Snell (1981) used Guttman scaling to classify samples of elderly on the "margin" of community, residential home and hospital care and estimated the cost of care for each disability group in each care location. Capital costs were included apart from the case of elderly living with others in the community. Informal help in the community was not costed and since there was a variety of substitution rates between informal and formal help, this led to substantial variation in the cost of community care within groups of elderly at specific points on the Guttman scale. This was particularly the case for the most dependent elderly in the community. This made comparisons with the cost of hospital care difficult. Some precision in the comparison was also lost by assuming the cost of hospital care for these very dependent community-based elderly would be the same for every individual. The conclusion was that home care cost was less than hospital care for very dependent elderly living with others and that considerable support services could be given to families caring for very dependent elderly, without raising the cost of home care to that of hospital care. The cost difference is emphasized by the omission of housing costs for these cases.

Estimates were obtained of residential home costs for elderly at different points on the Guttman scale, so a more detailed comparison of these costs, with the costs of home care is possible, although the problem of uncosted informal care and uncosted housing (for elderly living with others) remains. The authors found that community care was less costly than residential care for low dependency groups even for elderly who lived alone. There were 10 percent of cases where the cost of community care exceeded the average cost of residential care. Of course this percentage may have been higher if the cost of informal care had been included. A number of elderly could not be classified using the Guttman scale and this affects general statements that can be made about low or high disability groups.

Doobov (1979) approached the problem of categorizing elderly by considering two hypothetical levels of home care services, an average level, based on the current provision of home care services in Australia, and an intensive level. The intensive level was such that if elderly people were sufficiently dependent to require it, they would need institutional care if it were not provided. The cost of home care at each of these two levels was estimated. This included the cost of housing but not the cost of informal care. The cost of providing each of the two levels of care in nursing home was also estimated and the costs were compared with those of home care. The conclusion was that the cost of home care for elderly living with others is significantly less than the cost of nursing home care, but for elderly living alone the cost of home care is very close to that of nursing home care and could exceed it, if a large amount of home care services were needed. Hospital care was also costed and was found to be more expensive than any of the (hypothetical) levels of home care for any type of living situation considered. In the estimation of hospital care, the cost of the geriatric patients was separated from the cost of other patients in hospital. But an average cost was then used for all geriatric patients (although the author acknowledged that there would be a variation in resource use between patients in hospital care and that the costs for geriatric patients who could conceivably be cared for at home may be less than the average cost). As a result of this the comparison between the cost of home and hospital care is less precise than that between home and nursing home care.

Philips (1983) followed a similar line of research to that of Doobov but with some important extensions. Data was collected on samples of elderly in each mode of care. For home care, information was collected on formal services received and the total costs of care were estimated. These costs included housing and living costs. For a small sub-sample, the amount of informal personal care was recorded and costed.[1] The author found that when the cost of informal care was included, the gap between the average cost of home care and the average cost of nursing home (or hospital) care was much reduced.

Comparisons between the costs of each mode of care were also made for elderly at three hypothetical levels of care: minimal, average and intensive (compared to Doobov's two levels). The result depended upon the living situation at home. For all but one living arrangement at home the costs of an intensive package of home care exceeded the average cost of both ordinary and 'extensive' nursing home care. For half the categories of

---

1 The rate used was either the wage foregone, based on the average wage rate (weighted by the employment rate) or a (lower) leisure rate, dependent upon the circumstances of the carer.

living arrangements, the cost of an average package of home care also exceeded the costs of both levels of nursing home care. However, the estimates of the cost of each level of nursing home care were based on the average fees charged and some differential cost for medical care and pharmaceuticals. This does not take into account the difference in actual costs based upon the relative consumption of resources (particularly nursing care) in the nursing home. It is possible that the actual costs for the patients receiving an extensive level of care were higher than estimated, hence the conclusions relating to the cost comparison may not be valid. Similarly, the comparison between the cost of intensive home care and the cost of hospital care was based on average hospital cost so the conclusion, that hospital care is cheaper than home care may be misleading. It is possible that the cost in hospital of the elderly under consideration may have been less than the average hospital cost.

Philips estimated the direct nursing care of patients in the nursing homes and identified the marginal patients (defined as those for whom home care was a valid option). The direct care costs[2] of these marginal patients in nursing home was compared with the direct care costs of the sub-sample of elderly at home (for whom data was available on informal care costs). The costs were estimated for elderly at each point of the Katz dependency scale. The result was that the direct costs of home care exceeded those of nursing home care for patients on three points of the scale (3, 5 and unclassifiable), and were less for patients on the other five points (1, 2, 4, 6, 7). The cost

2 exclusive of hotel care.

differences were not related to dependency hence it is difficult to draw a general conclusion. There were two problems in using the Katz scale. Firstly a number of patients were non-classifiable. Secondly it is a broad classification scheme, so that the within class cost variation may be sufficiently large to swamp the between class cost differences. Only the mean costs for each class of patient (in each mode of care) were presented. Information on 'within class' cost variation was not reported so that the significance of the difference in the mean cost between home and nursing home care, for a particular class of patient, cannot be tested.

In the United States, a cost analysis was undertaken to determine whether nursing home patients could be cared for at less cost in some other care setting (Burton, Damon, Dellinger, Erickson and Peterson, 1978). A range of levels of care was costed out in each of four alternative settings including living at home. The cost of informal care was included and was estimated by the cost of hiring nursing personnel to provide the care. Nursing home care was found to be cheaper than any of the other options for 87 percent of the nursing home patients. However the nursing home cost used for comparison was an average cost, yet the authors noted that individual patients in nursing homes received a number of different levels of care, hence it is likely that the nursing home cost increases with level of care. It is therefore possible that the cost margin between home care and nursing home care is less than estimated, and could even be negative (i.e. nursing home costs could exceed home care costs). The method of costing informal care itself inflates the cost of home care. This is particularly true when costing the highest level of care in the home situation i.e. 24-hour care. The informal care time in this case was still costed as if using nursing personnel. Yet in the home situation this type of care can be provided at less cost. The authors note this but do not present a more realistic cost estimate.

5.3 COSTS OF COMMUNITY CARE

There are a number of pieces of research whose main emphasis is to estimate the cost of community care. They often include a comparison with the cost of institutional care but this cost is not estimated carefully. These studies are considered in this section. These studies emerged in quantity in the literature in the 1970's following the swing away from institutional care, towards community care, for the dependent elderly and other disabled persons.

Seidl Austin and Greene (1977) presented a framework for the analysis of the costs of home care based around five considerations:

(i) how the target population is defined

(ii) how clients are selected for inclusion in a home-care program

(iii) the structure of care management

(iv) the efficiency and quality of the service provided

(v) who bears the cost.

The first of the above considerations is relevant when comparing the cost of home care with the cost of institutional care. The authors define the 'who-but-fors', those who, but for the home care program, would be in institutional care, and stress the need to identify the costs of home care for these elderly (the "at-the-margin" elderly as defined by Mooney, 1978). They point out ((ii) above) that the *total* cost of home care programs may increase if the numbers using the program include people outside the target population and that the costs of nursing homes may increase if the less dependent elderly are in future cared for at home. (iii) and (iv) relate to the type of service delivered which of course influences cost and the last consideration (v), refers to the shift of cost from the state to the private individual which is often associated with home rather than hospital care.

(iv) is the essence of a much-cited piece of empirical research by Opit (1977) who measured and costed the resources used in the care of elderly people at home and found that there was an undersupply of domiciliary services in 30 percent of cases. He concluded that the economic advantage of home care over institutional care was due in part to this undersupply and that if the domiciliary services were provided at the appropriate level, the costs of home care would exceed that of hospital care in about five percent of cases, and exceed that of residential care in about 10 percent of cases. This study was similar to the research by Wager, but capital costs were not included. Once again average costs of institutional care were used, which may not have been appropriate to the elderly sampled. Although the presence of informal care was noted, no attempt was made to estimate the level or the cost.

A number of projects have been undertaken which are a response to Opit's findings that community care is cheaper because it is insufficient. Programs have been developed which increase the level of formal support to elderly in the community for an experimental group. The results in terms of the costs and benefits such as health status, disability levels, mortality etc. are compared with those of a control group who receive the 'normal' level of formal support. Results of such programs have found that the cost of the formal support is substantially higher for the experimental group but that mortality decreases (Challis and Davies, 1981, Weissert, Wan, Livieratos and Pellegrino, 1980) and that the costs are lower than institutional care in most cases (Challis and Davies, 1981, Gibbins, Lee, Davison, O'Sullivan, Hutchinson, Murphy and Ugwu, 1982). None of these studies include the cost of informal care so that the question of what the full cost is and how the costs are shared cannot be properly answered.

Although none of the cost analyses discussed so far include the cost of informal care, all acknowledge the importance of informal care. There have been other papers on how informal care might be costed (e.g. Chetwynd, S.J. 1983), suggesting the value of employment foregone and the cost of alternative labour (as discussed in Chapter 4). One study which has costed informal care was undertaken by Creese and Fielden (1977). The subject of the costing was not the elderly, but responauts who require someone in constant attendance (owing to breathing difficulties). Unpaid help was costed at the nursing attendant rate (the nursing attendant shared the caring with family members). The results were that the home care (at even this high level) was cheaper than the hospital care. The authors provide their own criticisms of the estimation. The main one is that the hospital cost used for comparison is an average over all patients and may overestimate the cost for responauts.

Research in the United States (Laurie, 1978) estimated the cost of home care for elderly in each of seven disability groups, based on the OARS classification scheme (discussed in Chapter 6). The cost included the cost of informal care, costed at the rate which would be paid if the state were to provide the care. The cost of home care for the most dependent group exceeded the average cost of nursing home care. Disability-related costs were not estimated for nursing home care, so it is not known how close is the average cost to the actual cost for this 'most dependent' group of elderly. Moreover no information was reported on the variability of home cost within a category.

5.4 DISABILITY-RELATED HOSPITAL COSTS

In the United States much research on the costs of institutional care has been conducted separately from studies on the cost effectiveness of home care services. The emphasis has been on cost effectiveness within the nursing home[3] sector, and to explain the differences in nursing home costs for the aged. The incentive for this research has been the increasing share of health expenditure consumed by nursing homes and funded by medicare and medicaid programs. A review by Bishop (1980) concluded that nursing home costs were determined by patient mix and services offered. More recent work by Lee and Birnbaum (1983) confirmed this result and developed a model, relating cost to the functional status of patients, services offered and input prices. They used the model to identify significant differences between nursing home costs after allowing for the different values of the independent variables. Meiners (1982) identified the importance of the range of therapeutic services available and the type of staff coverage provided, in determining costs, and found that 'mid-level' dependent residents were relatively more expensive to care for.

---

3 Nursing homes in the United States offer a similar level of care to geriatric hospitals in New Zealand.

Research is now being directed towards developing reimbursement systems based on the relationship between resource consumption and patient dependency. This will be discussed in Chapter 6.

5.5 NEW ZEALAND STUDIES

While there has been only one piece of empirical research addressing the question of the cost of care of the elderly in New Zealand, some other research is reported here because it includes some measurement of the use of resources and is of background interest to the subject being researched.

(a) Community Care

Koopman-Boyden and Wells (1979) estimated the time spent on particular care tasks by the principal supporters of a sample of dependent elderly who were admitted from the community to a geriatric assessment unit. An average of 13 hours each week was spent on physical tasks. The disability levels of the elderly were not recorded so that it is not possible to relate informal care input to disability. No cost information was obtained.

(b) Comparative Studies

A national survey of the elderly in 1972/73 (Salmond, 1976) compared the existing accommodation occupied and level of services received by a sample of elderly in the community and in institutions with that recommended by medical assessors based on the functional capacity of the individual. It identified sections of the elderly population in institutions who could be cared for elsewhere and provided guidelines for changes in the provision of services and types of accommodation which would meet the recommendations. The survey did not include any cost information, nor was it sufficiently detailed to allow exploration of the use of hospital resources for different classes of patient. It did not measure inputs by the family.

A survey by Scotts (1979) of the aged in home and institutional care in Canterbury included information on the disabilities of the elderly and the sources of help received. The amount of help was not recorded however so it is not possible to relate resource usage to level of dependency. The hospital part of the survey provides information on disability but not on resource use. No cost information was obtained.

(c) Cost of Care

The only comprehensive research undertaken on the costs of care of the elderly in New Zealand is that of Daldy (1982) who estimated the cost of caring for elderly of three hypothetical levels of disability in each of the care locations; at home, residential home and in hospital (this approach was based on that used by Doobov (1980) in the Commonwealth Department of Health study in Australia). Careful cost estimations were used to separate out the cost of geriatric patients from those of other patients in general hospitals, and to measure the cost of home services. The total costs in each mode of care included capital costs of buildings etc. and personal costs of the elderly. The cost of home care included living costs. The results were that home care at any of the three levels, for elderly living with others, was less expensive than any form of institutional care. For elderly living alone, the cost of care was greater than the cost of residential home care but less than the cost of hospital care. Private hospital care was found to be cheaper than public hospital care.

These results are to some extent a function of the costing methods used. The housing costs of home care were included only for elderly living alone. The community costs did not include the cost of informal care, and the author notes that if they were included, the cost of home care could exceed that of hospital care.

The cost of hospital care, in a particular hospital, for patients at each level of disability was assumed to be constant and was estimated by the average cost for all patients at a hospital. In reality it is likely that costs will vary with patient disability. Lastly it is not known how well the three hypothetical levels of disability represent the variation in the level or type of disability of the dependent elderly population.

In a later paper based on this research, Ward and Daldy (1982) discussed some of these drawbacks, particularly the loss of income of the carer, the possibility of different levels of care in hospital for patients of various levels of dependency, and the possibility of a level of care in the community exceeding all three hypothetical levels. They also noted that the average cost of care in public geriatric hospital exceeded that in private hospital largely because of higher staffing levels, and that this could be related to the different levels of patient disability in the two forms of care. The research presented in this thesis addresses these points.

5.6 SUMMARY

The review of some of the literature on costing of care for the dependent elderly has revealed two deficiencies. Firstly, a number of studies have omitted some costs, notably informal care costs and housing costs from the estimation of the total cost of community care. This is part of the reason for the conclusion that home care is cheaper than institutional care. Such an approach is unable to measure the shift to the family of the resource costs of care, particularly for very dependent elderly for whom the informal carer contribution is substantial. Omitting informal care costs distorts the distribution of home care costs for different disability levels, with the result that it is very difficult to make meaningful statements about the relationship between the cost of home care and disability level (e.g. as found by Wright, Cairns and Snell, 1981).

The second deficiency is the use of average institutional costs to estimate the cost of institutional care for individual 'dependent elderly' or groups of 'dependent elderly' without taking sufficient account of the level of dependency. Such average costs are adequate provided the 'dependent elderly' are (and remain) a homogeneous client group with similar resource usages. If, however, patients' resource usages differ sufficiently to cause the costs of care to be markedly different between individual patients, then the average cost must be used with caution.

Some studies have addressed this problem by identifying at the margin populations (e.g. Mooney, 1978), but without information on the level and variability of costs (or resource usages) of the sub-population compared to the parent population, the success of this strategy cannot be determined.

The average cost reflects the dependency mix of the clientele on which it is based. If cost comparisons between modes of care (e.g. public and private hospitals or home and institutional care) are made using average costs, then erroneous conclusions may result, since a mode of care may appear 'cheaper', entirely or partly because patients in that mode of care are less dependent. Again this may contribute to the conclusion that home care is less expensive than institutional care.

Using constant institutional costs does not take account of changes in the average cost in an institution if the dependency of the patients changes. Therefore the implications of a change in policy (e.g. an emphasis on community care) cannot be properly determined.

It is clear from these arguments, that in order to obtain estimates of cost which are useful for planning purposes and in order that meaningful comparisons can be made between the costs in different care settings, all costs should be included, and estimates of cost should be related to patient dependency. The research to be presented incorporates these features.

The problem remains as to how to measure disability and how to relate it to cost. Previous research in these areas will be considered in Chapter 6.

CHAPTER 6

MEASURING DEPENDENCY

CONTENTS PAGE

6.1	OBJECTIVES OF DEPENDENCY MEASURES	81
6.2	DISABILITY SCALES AND CLASSIFICATIONS	82
	6.2.1 Guttman Scale	83
	6.2.2 Katz Index of ADL	84
	6.2.3 Duke OARS Multidimensional Functional Assessment Classification	85
6.3	DISABILITY AND USE OF THE NURSING RESOURCE	86
	6.3.1 Classifications	87
	6.3.2 Regression Approach	88
6.4	DISABILITY CLUSTERS FOR COST REIMBURSEMENT	89
6.5	SUMMARY	92

CHAPTER 6

MEASURING DEPENDENCY

The arguments presented in Chapters 3 to 5 demonstrated the need to estimate variable costs, related to the dependency of the individual elderly person. This necessitates a suitable means of measuring dependency.

6.1 OBJECTIVES OF DEPENDENCY MEASURES

There are many reasons for measuring dependency and these determine the method of measurement selected. The purpose of specific interest in this research is to be able to estimate the cost for a particular 'type' of elderly person, or since cost is related to resource use, to predict the level of consumption of various inputs to care. This facility is required for each mode of care. The system should also be simple to use, since elderly will be assessed in the community where access to specialist facilities or personnel will be less than in hospital.

In the hospital situation, clinical diagnosis is used to describe patients. The purpose of the classification is for efficient delivery of the treatment program, appropriate to that diagnosis. But this has not been found to be helpful in providing an indication of the level of resources consumed in the care of the dependent elderly (e.g. Opit, 1977, Wager, 1972).

Medical treatments form a small proportion of the care of the dependent elderly. The main 'treatment' is nursing care i.e. assistance with washing, bathing, etc. The need for nursing care is the culmination of many factors, associated with the ageing process, as well as the clinical diagnosis. Moreover, several patients may have the same diagnosis but the condition diagnosed is suffered to varying degrees so that their need for care is quite different (e.g. people who have suffered strokes). Therefore systems of measuring dependency have been developed based on the disabilities with the essential tasks of everyday living e.g. dressing, bathing, etc. In order for these systems to form a suitable basis for cost estimation, they need to satisfy three criteria. They need to be:

(i) unambiguous

(ii) exhaustive

(iii) homogeneous with respect to resource use.

The score or classification alloted to individual elderly should be unambiguous. The system should be capable of classifying all elderly. Groups of elderly receiving the same scores or put into the same class should have similar cost, or similar resource use. In the following sections some systems of measuring dependency will be presented and judged according to the criteria above. Three types of systems will be discussed: disability scales and classifications, disability and use of the nursing resource, and disability clusters for cost reimbursement.

6.2 DISABILITY SCALES AND CLASSIFICATIONS

A number of instruments for measuring dependency have been developed in order to measure the extent of disability within a population (e.g. the elderly) and to compare disability between populations. Disability scales have an intuitive appeal since the several dimensions of disability are reduced to one and it is possible to order people by level of disability. Two scales will be considered: the Guttman Scale and the Katz Scale. Both scales depend upon an assumption of a cummulative pattern to the ageing process.

6.2.1 Guttman Scale

This scale was developed by Guttman (1950) and relates to populations where each individual can have a number of attributes. These attributes are acquired in a strict order, so that knowledge of the number of attributes of an individual is sufficient to determine what the attributes are. The individuals may be grouped according to the number of attributes and form a Guttman scale. Williams, Johnston, Willis and Bennett (1976) successfully used Guttman scaling to classify patients recovering after surgery, and disabled people living in the community. The attributes used were ability to do domestic tasks (e.g. cooking) and personal care tasks. Wright, Cairns and Snell (1981) used Guttman scales to classify elderly in different modes of care. The attributes were the disabilities with respect to personal and domestic care tasks. Between 22.5 percent and 38.5 percent of elderly sampled in each mode of care could not be classified i.e. they had the 'wrong set of disabilities.' Attempts by Green (1981) to use Guttman scaling on data collected by Scotts (1979) on elderly in the community were no more successful. Moreover separate scales were needed for men and women (a result also obtained by Williams et alia, 1976).

In order to be of use for estimating the costs of care, the Guttman scale must produce groups of elderly with similar resource use. Wright, Cairns and Snell (1981) found some association between care time given per week to people in residential homes, and their points on the Guttman scale but the relationship was not strong nor was it formally estimated.

The attributes are, in any case, represented as (0,1) variables i.e. presence or absence, in the Guttman scale. Hence no account is taken of degree of disability for a particular task e.g. toileting. Hence the scale would be unlikely to produce groups with a small variance in levels of resources used or total costs of care.

6.2.2 Katz Index of ADL

The Index of Activities of Daily Living (ADL) was developed using patients recovering from fracture of the hip (Katz, Ford, Moskowitz, Jackson and Jaffe, 1963). Katz observed that there was an ordering of recovery of various self-care functions (activities of daily living) parallel to the order in which a child develops these skills. Six activities are considered and the ordering is feeding, continence, transferring, going to toilet, dressing and bathing, and people are placed at one of seven points on the ADL scale according to the number of disabilities with these tasks. The ordering is not as strict as for the Guttman scale. The seven points on the ADL scale specify 0 - 5 specific disabilities but allow the possiblity of one unspecified disability. For example point D on the scale is for a patient who needs help with bathing, dressing and one other task.[1] The effect of this is that more patients can be classified.[2] Katz found that 96 percent of people could be classified using the index. The scale is easy to use and has been of great practical value in following up patients after

---

1 In fact Katz found that the 'other' task was the next task in the sequence in 86 percent of cases and the one after that in a further seven percent of cases.

2 Some of the cases that would be unclassifiable on the Guttman scale are 'spread' over points on the Katz scale.

illness, in describing populations and comparing treatment programs (see Katz and Akpom, 1976, and Katz, Hedrick and Henderson, 1979). The conditions for being disabled for a particular task are precisely described, yet as with the Guttman scale, degree of disability is not otherwise considered. Moreover the 'other' task could increase the variability of resource use or cost within a patient grouping, particularly at lower levels of dependency.

Philips (1981) used the Katz scale for classifying elderly, and seven percent of nursing home patients and 21 percent of hospital patients were non-classifiable. The nursing care was estimated for each patient in nursing homes and the mean nursing care costs for elderly at each point on the scale were compared. The means were not monotonically increasing (with disability) which is a somewhat unsatisfactory result, but the means did differ numerically. However, the variances of the costs of care time of elderly at each point on the scale were not reported so it is not possible to say whether the differences between the means were significant.

6.2.3 Duke OARS Multidimensional Functional Assessment Classification

The Duke, Older Americans Resources and Services, or OARS classification involves a comprehensive assessment in five dimensions: social and economic situations, mental health, physical health and ADL, each on a six point scale yielding 6^5 (=7776) classes (Multidimensional Functional Assessment: the OARS Methodology, 1975). It is designed to measure the status of older populations and to compare the status over time or following social and health care programs etc., or to compare one population with another. The six points are usually reduced to two (1 - 3 unimpaired; 4 - 6 impaired) yielding 32 classes, and further reductions have been made for specific applications. Twenty four generic classes have been identified as a core, and service packages of care appropriate to these classes have been constructed (Dellinger, 1978). Burton et al. (1978) used five of these care packages when estimating the cost of home care for nursing home patients (discussed in Chapter 5). Laurie, (1978) used an aggregation of the OARS scale into seven classes to estimate the costs of home care for elderly living in the community (discussed in Chapter 5). Neither of these studies provide information on the variation in resource use within a class.

6.3 DISABILITY AND USE OF THE NURSING RESOURCE

Nursing care is the major input of hospital care of the elderly. There has been much research, particularly in the United Kingdom and Canada, into the relationship between nursing care time and measures of patient disability in order to develop patient classification systems which could be used to assist in determining ward staffing levels. (For a review of some classification systems see Barr, Moores and Rhys-Hearn, 1973).

Early work by Connor, Flagle, Hsieh, Preston and Singer analysed the direct care (individual to a patient, e.g. bathing) and indirect care (administration, supervision etc.) in a general hospital and found that while indirect care did not vary significantly between patients, there was a large variation between patients in the consumption of direct care. A further finding was that the direct care for an individual patient was related to the level of disability. This same result has been found to apply to geriatric patients (e.g. Magid and Rhys

Hearn, 1981, Scottish Home and Health Department, 1969). Hence it is the direct nursing care which is the main determinant of the differing nursing requirements of patients in hospital.

6.3.1 Classifications

Many studies of the relationship between care times and patient characteristics have classified patients into care groups and estimated a mean care time for each group (for example, Chagnon, Audette, Lebrun and Tilquin, 1978; Oxford Regional Hospital Board, 1967; Scottish Home and Health Department, 1969; Connor, Flagle, Hsieh, Preston and Singer, 1961). These classifications have been used to determine ward staffing levels, using formulae (e.g. the Aberdeen formula developed by the Scottish Home and Health Department, 1969) or nursing workload packages (e.g. Rhys Hearn, 1979 and 1983). The process of aggregation into classes may cause valuable information to be lost: the variation within each group is suppressed. Using the results in further calculations e.g. for estimating ward workloads, relies on the population size (number of patients in the ward) being sufficiently large to absorb the within group variation.

Some studies have taken steps to overcome this problem. For example, one study (Rhys Hearn and Potts, 1978) introduces weights which contain a component for the number of dependency factors an individual patient has. The presence of each factor (e.g. unco-operative, confused) increases the time taken for nursing tasks above the average for the care group. The predictive ability of this model for an individual patient is not stated. However the model was developed to determine ward staffing levels and is probably not intended to be an accurate predictor of care time for the individual patient.

6.3.2 Regression Approach

Rather than classifying patients into disability groups, some studies have used regression analysis in order to explain more of the variation in care time.

Barr (Oxford Regional Hospital Board, 1967) develops a multiple regression model to explain care time using various sets of (0,1) dummy variables showing patient characteristics and special treatments required. The best value of R^2 (measuring the predictive power of the model) was .45. The client population is wide (all patients in an acute hospital) therefore there is much variation to explain. One would expect better model performance by considering a more homogeneous sub-population e.g. the elderly. However, some improvement may also have been possible by using a finer scale for the explanatory variables.

Such variables were used by Kuhn (1980) who obtained an R^2 as high as .8 for patients in general nursing units in a neurological centre. However the dependent variable used was the average daily number of times a nurse was observed attending to a particular patient (calculated from observations at 15 minute intervals during an 8 hour day over a two week period). No information on the closeness of this variable to actual nursing time is given. It should be noted that one cannot compare the value of R^2 so obtained with those of models using care time as the dependent variable. In addition, since the dependent variable is an average (of data collected over a two week period) this will, in any case, reduce the variance to be explained and so increase the calculated value of R^2.

None of the studies cited above quote the prediction errors of the resultant models. Nor do they provide substantive evidence that the statistical assumptions underlying their estimation procedures do indeed hold. Therefore the validity of these models is open to question.

6.4 DISABILITY CLUSTERS FOR COST REIMBURSEMENT

The latest research in disability classification for the dependent elderly conducted in the United States has been to identify homogeneous patient groups for long-stay care (similar to the diagnostic-related groups for acute care). The homogeneity is with respect to resource use, particularly nursing care. The purpose is to develop a scheme for reimbursement of nursing home facilities which takes into account the type of patient being cared for. To some extent these patient groups are similar to those produced by the classifications (in 6.3.1). But the estimation procedures used are more rigorous and other resources in addition to nursing care may be incorporated into the analysis.

Fries and Cooney (1985) developed resource utilization groups (RUG's) using AUTOGRP, (a stepwise partitioning procedure to produce clusters with minimum predictive error of a specified dependent variable (Mills, Fetter, Riedel and Averill, 1976)). Data was collected on disability levels (and other characteristics) of patients in nursing homes and the patients were grouped according to their use of nursing care. Nine RUG's were obtained and these explained 37.8 percent of the variance in nursing care. The dependent variable was subjectively determined i.e. it was based on the time nurses estimated they spent with the individual patients. Moreover it was measured on a five point scale, representing the relative time spent on a patient. Actual nursing times for a subset of data were compared with the values of the dependent variable and the correlation was 0.57. Hence the dependent variable explains only 32.5 percent of actual nursing time. Therefore if actual nursing time had been used as the dependent variable the percentage of its variation explained by the nine RUG's would have been less than the 37.8 percent quoted above. The RUGs themselves had mean values for the dependent variable ranging from 2.12 to 4.53 (compared to the overall mean of 3.22). The standard deviations ranged from 0.82 to 0.98 for eight of the groups. One group had a standard deviation of 0.66 (the lowest); another of 9.6 which is unacceptably high. The overall standard deviation was 1.16.

Cameron (1985) addressed some of the problems with the Fries and Cooney patient groupings. The dependent variable used here was based on the nursing time for individual patients. Using AUTOGRP on measures of patient disability, 13 patient groups were obtained which explained 68.5 percent of the variation in nursing time. However the dependent variable used here was 'work units'. These were based on standard times for services delivered to patients, weighted by the average cost (within a region) of providing those facilities. Information on services given to patients was obtained from care plans, medical records etc. The use of average costs is an essential feature of a system which is to be the basis of cost reimbursement. Use of standard times produces a dependent variable with less variance than would be exhibited by using actual resource use. This may be acceptable for a system dealing in large numbers of patients. But it increases the percentage of variation explained. No information is provided on the variation of actual resource use or upon how well the patient groups explain this variation.

The mean work units for each group range from 350 to 1396 compared to a global mean of 686. The standard deviations range from 90 to 276. Unfortunately the global standard deviation is not reported, so that a comparison of this with the group standard deviations cannot be made.

Cooney and Fries (1985) have derived RUGs on two further data sets, using actual nursing time as the dependent variable. The specific measure of actual nursing time was the time spent by nurse aides, since there seemed to be little relationship between patient characteristics and qualified nurse time. Seven RUGs were obtained for the first data set (of patients in facilities offering "superior care, efficiently") and explained 34 percent of the variation in nurse aide time. The standard deviation of care time for the groups ranged from 20 to 46, compared with the overall standard deviation of 50. Eight RUGs were obtained from the second data set (of patients in facilities representing "a spectrum of quality of care") and explained 53.8 percent of the variation in nurse aide time. The standard deviations of the groups ranged from 26 to 71 compared to the overall standard deviation of 77. The groups produced for these two data sets differed from those obtained from the Yale data (Fries and Cooney, 1985) but the same set of independent variables (all disability measures) were responsible for the classifications, and the three classification systems divided up a particular data set in similar ways. This research is continuing, focusing on the relative weights of the groups, (in order to produce a cost index) and on the stability of the groups over time. The success of a system of cost reimbursement based on the RUGs depends upon the number of patients in a facility being sufficiently large to absorb the within-group variation in care time.

6.5 SUMMARY

The review of the literature on patient dependency measures has established the importance of measures of disability in determining resource use, and therefore cost, in the care of the dependent elderly. Nursing care is the resource which is likely to vary between elderly on account of the level of dependency, and the variation in the use of nursing resources arises from the variation in the consumption of direct nursing care. Therefore the ability to explain the variation in costs between types of patients or to predict costs for groups of patients hinges upon the relationship between direct nursing care and disability levels, and upon how well it can be estimated.

This review has shown how attempts have been made to use various measures of dependency to classify elderly patients in terms of their use of the nursing resource.

The Katz and Guttman scales whilst being simple and unambiguous to use suffer from the drawback that a proportion of elderly cannot be classified. Moreover groupings of patients using these scales have not been found to be homogeneous with respect to the use of the nursing resource.

Many other classification systems have been tried. In some instances authors fail to report the variation in nursing care time for patients within the resultant patient groups so that the predictive ability of the methods cannot be determined. In other cases, proxy variables have been used for nursing care time with the result that the value of R^2 or other measure of predictive ability is inflated (compared to the value it would take if actual nursing care were used as the dependent variable). Where actual nursing time has been used, reported predictive ability has not been high. Hence the problem of developing disability measures and relating them to resource use so that the resource use can be successfully predicted, needs to be researched further.

Rather than developing a patient classification system, which suffers from the disadvantage that variation within a class is suppressed, the research to be presented here takes a regression approach to estimate the relationship between direct nursing care and disability measures. The analysis is presented in Chapter 6.

SECTION II

EMPIRICAL WORK ON THE COST OF CARE OF THE DEPENDENT ELDERLY

CHAPTER 7

DEPENDENCY AND USE OF THE NURSING RESOURCE

CONTENTS PAGE

7.1	INTRODUCTION	94
7.2	THE SAMPLES	95
	7.2.1 Public Hospital Care	95
	7.2.2 Private Hospital Care	95
	7.2.3 Community Care	96
7.3	DATA COLLECTION	97
	7.3.1 Direct Nursing Care	97
	7.3.2 Disability Assessment	98
7.4	RESULTS	103
	7.4.1 Disability	103
	7.4.2 Direct Nursing Care	113
7.5	DISABILITY AND DIRECT NURSING CARE	120
7.6	MODELLING THE DISABILITY-DIRECT NURSING CARE RELATIONSHIP	128
	7.6.1 Introduction	128
	7.6.2 Private Hospital Patients	128
	7.6.3 Public Hospital Patients	149
	7.6.4 Community Sample	159
	7.6.5 Applicability and Limitations of the Models	160
7.7	IMPLICATIONS OF THE RESULTS	162
7.8	SUMMARY	163

CHAPTER 7

DEPENDENCY AND USE OF THE NURSING RESOURCE

7.1 INTRODUCTION

A major objective of the project was to obtain estimates of the way that the cost of care of the dependent elderly is related to patient dependency, in order to make meaningful comparisons of the costs of care in different care environments.

If the costs of care, in a particular care setting, vary between patients, this will be due to the differing amounts of resources consumed on account of the level of dependency. Nursing salaries account for a substantial proportion of the total cost of geriatric hospital care, therefore the relationship between the use of the nursing resource and patient dependency is of major importance.

In the first part of this chapter, the assessment instrument used to measure patient dependency is described, and the disability measurements on samples of patients in public and private hospitals, and in community care, are presented and compared.

In the second part of the chapter, the relationship between measures of patient disability and the consumption of the nursing resource is explored, and models are developed, using data collected on the patients sampled.

7.2 THE SAMPLES

Dependent elderly were sampled from three care environments: public geriatric hospital, private geriatric hospital, and the community. The patients in public hospital were receiving long-term care. The private hospital sample included both long and short-stay patients.

7.2.1 Public Hospital Care

The hospital sampled was the main geriatric hospital in Christchurch. It had 117 geriatric beds (of the 202 public hospital geriatric beds in the area). It was very similar in terms of staffing levels, cost per occupied bed and average patient dependency to the other public geriatric hospitals in the city.[1] Data was collected during a two month period in 1984. There were 37 men and 80 women occupying the beds at that time.

7.2.2 Private Hospital Care

Two private hospitals were sampled. One, a women's hospital, had 76 beds; the other, for men, had 33 beds. Both were run by the same (non-profit-making) organization. These hospitals were chosen because they offered some short-stay beds and hence provided an opportunity to make a direct comparison of the costs of hospital and community care for the patients using these beds. The fees, size and age of the sampled hospitals were not significantly

---

1 The representativeness of the public hospital sampled is discussed fully in chapter 8, section 8.2.

different from those of the other non-profit making hospitals in the area.[2] A brief analysis of the costs of four further hospitals showed the average costs of the sampled hospitals to be representative of the cost of non-profit making hospitals (see section 9.9.2).

Two samples were taken. The first sample in 1982 consisted of all patients in two wards of each hospital. Most of these were long-stay patients. The second sample in 1983 was of all short-stay patients admitted during a four month period.

Some short-stay patients were receiving post-operative care. These were excluded from the study on the grounds that their care requirements are outside 'basic geriatric care' and might better be modelled separately.

The total sample size was 199, comprising 141 from the women's, and 58 from the men's hospital. There were 61 long-stay and 138 short-stay patients.

7.2.3 Community Care

It is generally accepted that there is an overlap in the level of dependency of the elderly in community and hospital care. Some very dependent elderly can continue to remain in the community if adequate support from family and other services is available. An objective of the project was to compare the cost of elderly receiving community care with those in long-stay hospital care, for elderly *of comparable dependency*. The difficulty is in identifying the elderly in the community who are sufficiently dependent.

---

2 The choice of hospitals is discussed fully in chapter 9, section 9.2.

All the (138) short-stay patients in the private hospital sample were being cared for in the community. Most of them had been admitted to provide relief for their carers (usually family members) at home. Hence they form part of the population of 'dependent-elderly-in-community-care', which is of interest.

The subsample of short-stay patients admitted during a four month period in 1983 was used as a basis for obtaining information on care in the community environment. The sampling procedure is discussed in detail in chapter 10 (section 10.2). Seventy-two patients (26 men, 46 women) were followed up at home after leaving hospital. This group will be called the community sample.

7.3 DATA COLLECTION

Two types of data were collected for each patient sampled.

(a) a record of direct nursing care over a 24-hour period,

(b) an assessment of the patient's disabilities.

7.3.1 Direct Nursing Care

The object of the data collection was to measure the amount of direct care received by each patient. Direct care is defined as patients' individual nurse-contact care e.g. toileting, bathing, dressing, feeding, washing. It does not include ward supervision, administration or domestic duties carried out by nursing staff. These tasks are included under indirect care.

Some indirect care is specific to the individual patient e.g. the compilation of a nursing care plan, but the majority is shared with other patients e.g. supervision, serving of meals, etc. The allocation of indirect care to individual patients is assumed to be on an equal basis. This is discussed in more detail in chapter 8 (section 8.5.4) and chapter 9 (section 9.5.4). This chapter is concerned with nursing resources which vary between patients and is therefore confined to direct nursing care.

Only one patient per ward was monitored on a given day to minimize the amount of extra work for the nursing staff.

Each time any nurse was involved in the care of the patient under study she recorded on a log-sheet a brief description of the task e.g. bathing, dressing, etc., and the start and finish times. From this it was possible to determine the patient's total individual usage of nurse time over the 24 hours. This procedure recorded only direct nursing time.

The time involved in data collection on a given day was small and was accommodated with minimal disturbance to the ward routine.

7.3.2 Disability Assessment

The development of an instrument to measure disability was initiated in the private hospitals sampled. The objective of this measurement was to find patient characteristics which would be good indicators of the amount of nursing care required. Discussions with the ward sisters produced the following list which includes measures of functional capacity and self-care disabilities:

age	ability to dress
medical diagnosis	ability to wash
mobility	ability to bath
mental capacity	ability to toilet
vision	ability to feed
hearing	ability to get up
incontinence	ability to go to bed
	need for pressure area care[3]
	use of catheters

An assessment form was designed based on these items. (see appendix 1). Each item was measured using several points on a scale to capture the variation in level of disability. The number of nurses required to assist the patient with each task was also noted.

The ward sister completed the assessment form for each patient, as close as possible to the day of monitoring the patient's care. A score was given for each item with high scores corresponding to greater dependency or functional incapacity. The items were tested for inter-rater reliability and the results are reported in appendix 1.

The sampling of patients in the public hospital followed that in the private hospital, and the assessment form was enlarged and some scores extended to take into account the greater dependency of the public hospital patients (see appendix 1). The changes were effected to retain compatibility with the private hospital data form, so that it was possible to compare the disabilities of patients in the two modes of care.

---

3. Pressure area care was recognised by the nursing staff as a significant user of their time.

7.4 RESULTS

7.4.1 Disability

The percentage of patients at each point on the disability scales are shown in Table 7.1. Separate results are shown for the public hospital sample and the private hospital short-stay and long-stay samples. χ^2 tests of significance on the numbers of patients in each category (for each assessment item) showed that in the private hospitals there were significantly greater proportions of long-stay compared to short-stay patients in the higher dependency categories for all assessment items apart from dressing, vision and use of catheters. For the long-stay patients a greater proportion of the public hospital patients compared to the private hospital patients were in the higher dependency categories.

Each patient was awarded a numeric score on each assessment item. The number of nurses required to assist with each task was incorporated into the final scores for each self-care assessment (see Table 7.1).

In the following sections the mean disability scores on each assessment item are compared for different sub-groups i.e. private hospital long-stay patients with public hospital long-stay patients; short-stay private hospital patients with long-stay private hospital patients; men with women patients; the community sample with all short-stay patients.

TABLE 7.1

PERCENTAGE OF PATIENTS AT EACH POINT ON DISABILITY SCALES(1) FOR EACH MODE OF CARE

Score	Age	Public Hospital Long-stay %	Private Hospital Long-stay %	Private Hospital Short-stay %	Significance (3)	Significance (4)
	-64	9.5	0.0	3.6		
	65-69	15.5	3.3	5.1		
	70-74	10.3	9.8	21.7	0.02	0.13
	75-79	11.2	19.7	18.1		
	80-84	24.1	24.6	22.5		
	85-89	17.2	21.3	18.8		
	90-	12.1	21.3	10.1		
	Mobility					
1	Walks unaided	3.4	23.0	27.5		
2	Walks with aid	12.1	36.1	42.8		
2	Self-Mobile in wheelchair	20.7	3.3	0.7	0.00	0.06
3	Mobile - wheel-chair at times	0.9	3.3	1.4		
4	Walks with assistant	8.6	9.8	16.7		
5	Chairfast	48.3	14.8	8.7		
6	Bedfast	6.0	9.8	2.2		
	Mental Capacity					
1	Not impaired	19.0	39.3	60.9		
2	Forgetful	19.8	26.2	11.6	0.00	0.00
3	Confused	32.8	19.7	22.5		
4	Disturbed	19.8	14.8	5.1		
	Unresponsive	8.6	0	0		
	Urinary Incontinence					
1	Continent	22.4	59.0	76.8		
2	Accidents	19.0	16.4	15.2	0.00	0.00
3	Incontinent	58.6	24.6	8.0		
	Bowel Incontinence					
1	Continent	35.3	70.5	87.0		
2	Accidents	21.6	23.0	10.9	0.00	0.02
3	Incontinent	43.1	6.6	2.2		
	Vision					
1	Good	20.7	39.3	51.4		
2	Fair	52.6	50.8	37.0		
3	Poor	25.0	9.8	11.6	0.01	0.18
4	Blind	1.7	0	0		

TABLE 7.1 (continued)

Score		Public Hospital Long-stay %	Private Hospital Long-stay %	Private Hospital Short-stay %	Significance (3)	Significance (4)
	Hearing					
1	Good	38.8	49.2	59.4		
2	Fair	38.8	47.5	30.4		
3	Poor	12.9	3.3	10.1	0.01	0.03
4	Deaf/cannot determine	9.5	0	0		
	Dressing					
1	Unaided	4.3	31.1	37.7		
2	Needs help (1)	82.8	62.3	60.9	0.00	0.12
3	Needs help (2)	12.9	6.6	1.4		
	Feeding					
1	Unaided	30.2	62.3	68.1		
2	Food cut up	31.0	23.0	28.3	0.00	0.02
3	Is fed	38.8	14.8	3.6		
	Bathing					
1	Unaided	2.6	13.1	8.7		
2	Help in/out	2.6	24.6	44.9	0.00	0.04
3	Is bathed (1)	64.7	36.1	30.4		
4	Is bathed (2)	30.2	8.0	11.1		
	Washing					
1	Unaided	26.7	75.4	83.3	0.00	0.11
2	Needs help (1)	70.7	19.7	15.9		
3	Needs help (2)	2.6	1.5	0.5		
	Toileting					
1	Unaided	1.7	47.5	43.5		
2	Commode	12.1	0.0	5.1		
3	Night help (1)	2.6	6.6	14.5		
4	Night help (2)	0.9	0.0	0.0	0.00	0.00
5	Day help (1)	5.2	4.9	4.3		
6	Day help (2)	0.0	0.0	0.0		
7	Always help (1)	18.1	19.7	26.8		
8	Always help (2)	59.5	21.3	5.8		
	Pressure Area Care					
1	Not required	18.1	60.7	79.0		
2	Light (1)	28.4	16.4	16.7		
3	Heavy (1)	3.4	3.3	3.6	0.00	0.00
4	Light (2)	15.5	9.8	0.7		
5	Heavy (2)	34.5	9.8	0.0		

TABLE 7.1 (continued)

Score		Public Hospital Long-stay %	Private Hospital Long-stay %	Private Hospital Short-stay %	Significance (3)	Significance (4)
	Uses Catheter/Uridome					
1	No	86.2	90.2	96.4	0.60	0.15
2	Yes	13.8	9.8	3.6		
	Getting Up					
1	Unaided	4.3	31.1	32.6	0.00	0.06
2	Needs help (1)	31.0	42.6	54.3		
3	Needs help (2)	64.7	26.2	13.0		
	Going to Bed					
1	Unaided	6.0	54.1	39.1	0.00	0.00
2	Needs help (1)	28.4	23.0	54.3		
3	Needs help (2)	65.5	23.0	6.5		

(1), (2) These numbers in brackets refer to the number of persons needed to assist with a care task.

(3) Significance of χ^2 test comparing long-stay private hospital patients.

(4) Significance of χ^2 test comparing short-stay with long-stay private hospital patients.

(a) Long-Stay Patients

The mean disability scores for long-stay patients in the public and private hospitals sampled, are presented in Table 7.2.

TABLE 7.2

MEAN DISABILITY LEVELS[1] OF LONG-STAY PATIENTS IN PUBLIC AND PRIVATE GERIATRIC HOSPITALS

	Public	Private
age	78.25	83.16 **
mobility	3.83	2.84 **
vision	2.08	1.70 **
hearing	1.93	1.54 **
urinary incontinence	2.36	1.66 **
use of catheter	1.14	1.10 NS
bowel incontinence	2.08	1.36 **
mental capacity	2.79	2.10 **
dress	2.08	1.75 **
feed	2.09	1.52 **
bath	3.22	2.75 **
wash	1.76	1.30 **
toilet	6.37	3.70 **
pressure area care	3.20	1.92 **
getting up	2.60	1.95 **
going to bed	2.59	1.69 **
number of patients	117	61

** significantly different at the 0.005 level
(1) higher scores represent greater dependency (see Table 7.1)

The private hospital patients were on average older than the public hospital patients. However, the mean scores on all functional capacity and dependency measures were greater for patients in public hospital compared to the private hospital patients. These differences were highly significant ($p < 0.005$) apart from use of catheters for which there was no significant difference.

The dependency scores of men and women were compared (see Table 7.3). The men in public hospital were significantly less dependent than women in all the self-care disabilities. They were younger, more mobile and had less mental incapacity. There was no significant difference between levels of incontinence, vision or hearing. In the case of the private hospital patients, few significant differences were found between dependency levels of men and women. Although the women had numerically higher scores on most assessment items, the only significant results were for feeding and age. In private hospital, men had a significantly higher level of urinary incontinence than women, whereas in public hospital the level was (insignificantly) lower.

Comparisons between mode of care were made for each sex separately. The women in public hospital were younger but significantly more dependent on all other assessment items than the women in private hospital. There was much less difference, however, between the mean dependency scores of the men in each mode of care. The men in public hospital were again younger and had significantly higher scores only for bowel incontinence and use of catheter.

The results show that the long-stay public hospital patients were on average a more dependent group than the long-stay private hospital patients, and that this was due mainly to the women in public hospital, who were on average much more dependent than the men. There was very little difference between the average dependency levels of the long-stay men and women patients in private hospitals.

TABLE 7.3

COMPARISON OF DISABILITY LEVELS(1) OF MALE AND FEMALE LONG-STAY PATIENTS IN PUBLIC AND PRIVATE HOSPITALS

	Public			Private		
	men	women		men	women	
age	72.56	80.81	**	80.20	86.03	**
mobility	2.67	4.36	**	3.03	2.65	NS
vision	2.03	2.10	**	1.73	1.68	NS
hearing	1.78	2.00	NS	1.47	1.61	NS
urinary incontinence	2.25	2.41	NS	1.93	1.39	*
use of catheter	1.39	1.02	**	1.17	1.03	NS
bowel incontinence	1.94	2.14	NS	1.42	1.29	NS
mental capacity	2.17	3.08	**	2.20	2.00	NS
dress	1.94	2.15	*	1.87	1.65	NS
feed	1.83	2.21	*	1.73	1.32	*
bath	3.03	3.31	*	2.70	2.81	NS
wash	1.42	1.91	**	1.33	1.26	NS
toilet	4.53	7.20	**	3.73	3.68	NS
pressure area care	2.44	3.54	**	2.23	1.61	NS
getting up	2.17	2.80	**	2.00	1.90	NS
going to bed	2.14	2.80	**	1.80	1.58	NS
number of patients	37	80		30	31	

* significant at the 0.05 level
** significant at the 0.01 level
(1) higher scores represent greater dependency

(b) Short-Stay Hospital (Community Based) Patients

The results of the assessment of short-stay patients (while they were in the private hospitals) are shown in Table 7.4. The women were older than the men and had numerically higher scores on all items apart from bowel incontinence, mental capacity and use of catheters. The only significant differences were for pressure area care (for which the women were more dependent) and bowel incontinence (for which the men were more dependent).

The short-stay patients were compared with the long-stay private hospital patients. This is, in fact, a comparison between the dependency of elderly in community and long-stay private hospital care. As might be expected, the long-stay hospital patients had higher mean scores on all items (see Tables 7.2 and 7.4). The results of tests of significance between the two groups are shown in Table 7.4. The long-stay patients appear to be significantly older and significantly more dependent with respect to urinary and bowel incontinence, mental capacity and pressure area care. The proportion of women in the sample of short-stay patients is, at 74 percent, greater than that for the long-stay sample (51 percent). Since there were some differences in disability between the men and the women patients, this may distort the tests of significance. The scores for the short-stay patients were therefore weighted to correct for the differing proportions of women in the two subgroups. The resulting tests of significance, using the weighted sample (see Table 7.4) showed that the only significant differences between the long and the short-stay patients were for age, urinary incontinence and pressure area care. The apparent differences for bowel incontinence and mental capacity are due to the greater proportion of women in the short-stay, compared to the long-stay, sample.

Although the mean scores of some assessment items for the short-stay patients have been shown to be less than for the long-stay patients, the variation around these means is sufficiently large so that there is considerable overlap of the dependency of patients found in the two subgroups. For example the standard deviations for urinary incontinence were 0.66 and 0.85 for short-stay and long-stay patients respectively.

Tests of significance to compare the short and long-

TABLE 7.4

COMPARISON OF DISABILITY LEVELS(1) OF MALE AND FEMALE SHORT-STAY PATIENTS IN PRIVATE GERIATRIC HOSPITALS

	Short-stay		All short-stay	Comparisons with long-stay private hospital patients			
	Men	Women		All sample	Weighted sample(2)	Men	Women
age	77.69	80.23	79.57	***	***	***	NS
mobility	2.06	2.55	2.42			**	NS
vision	1.44	1.66	1.60				
hearing	1.42	1.54	1.51				
urinary incontinence	1.47	1.25	1.31	***	*	*	NS
use of catheter	1.08	1.02	1.04				
bowel incontinence	1.33	1.09***	1.15	**	NS	NS	*
mental capacity	1.97	1.63	1.72	*	NS	NS	NS
dress	1.53	1.68	1.64			*	NS
feed	1.33	1.36	1.36			*	NS
bath	2.39	2.59	2.54				
wash	1.19	1.17	1.17				
toilet	2.69	3.34	3.17				
pressure area care	1.06	1.33 **	1.26	***	***	***	NS
getting up	1.78	1.81	1.80				
going to bed	1.69	1.67	1.67				
number of patients	36	102	138				

*   significant at the 0.05 level
** significant at the 0.01 level
*** significant at the 0.005 level
(1) higher scores represent greater dependency
(2) the scores for the short-stay patients have been weighted to correct for the different ratio of men to women, compared to the long-stay sample.

stay patients were also performed for the men and women separately. The results (in Table 7.4) are different in the two cases. The short-stay men are significantly younger and less dependent in mobility, urinary incontinence, dressing, feeding and pressure area care, compared to the long-stay men. The short-stay women are significantly less dependent than the long-stay women for bowel incontinence only.

In summary, there was very little difference between the overall dependency of the men and women short-stay (i.e. community based) hospital patients. The short-stay patients as a whole formed a less dependent group than the long-stay private hospital patients, (the particular assessment items reflecting this lower dependency being different for men and women). However, patients of similar dependency could be found among the short-stay and long-stay private hospital samples, so that the two subgroups overlapped to some extent.

It was shown in (a) that the long-stay patients in public hospital were much more dependent than those in private hospital. Therefore the average dependency difference between the short-stay, community based, patients and those in public hospital long-stay care was even greater.

(c) Representativeness of Community Sample

All the 138 short-stay private hospital patients were based in the community. Data was subsequently collected on 72 of these patients, (the 'community sample'), on the care they received in the home environment. The dependency of this community sample is now discussed.

The average disability levels of the community sample, based on data collected while they were in hospital, are shown in Table 7.5. As was the case for all the short-stay patients, there was very little difference between the overall dependency of the men and women. The only significant difference was for age, the women being older.

The community sample was compared with the remaining (68) short-stay patients in order to establish how representative the community sample was, of short-stay patients in general. The community sample was weighted to correct for the different ratios of men to women patients in the two subgroups. The community sample had numerically lower scores on all assessment items. These differences were significant for mobility, feed, getting up and going to bed (shown in the last column of Table 7.5). The community sample formed a less dependent group than the other short-stay patients. A possible explanation for this is that elderly who had died since leaving hospital, were not included in the community sample (see Chapter 10, section 10.2.3). It is likely that these elderly were among the most dependent of the short-stay patients.

When the elderly in the community sample returned home after their hospital stay, assessment forms were completed by their carers in the community. Comparing these carer assessments of the elderly (Table 7.6) with those by the hospital staff (Table 7.5) it can be seen that the carers viewed the elderly to be more dependent than did the hospital in most assessment items. The exceptions were for toileting, getting up and going to bed, for which the mean hospital scores were greater. These results may be due to differences in care policy (e.g. the hospitals may encourage the patients to be more mobile) or to differences in the physical characteristics of the care environments (e.g. the distance between bedroom and toileting facilities may be greater in hospital).

TABLE 7.5

COMPARISON OF DISABILITY LEVELS OF 70[1] DEPENDENT ELDERLY MEN AND WOMEN IN THE COMMUNITY : HOSPITAL ASSESSMENT

	Men	Women	Men v Women	All	Comparison with other short-stay patients
age	76	81	*	79	
mobility	2.12	2.04		2.07	**
vision	1.40	1.69		1.59	
hearing	1.36	1.64		1.54	
urinary incontinence	1.44	1.31		1.36	
use of catheter	1.04	1.02		1.03	
bowel incontinence	1.36	1.16		1.23	
mental capacity	1.80	1.67		1.71	
dress	1.56	1.56		1.56	
feed	1.28	1.24		1.26	*
bath	2.48	2.60		2.56	
wash	1.20	1.18		1.19	
toilet	2.88	2.91		2.90	
pressure area care	1.04	1.22		1.16	
getting up	1.80	1.67		1.71	*
going to bed	1.72	1.51		1.59	*
number	25[1]	45		70[1]	

* significant at the 0.05 level

** significant at the 0.01 level

(1) The community sample comprised 72 patients. But two patients (both men) were not assessed while in hospital

TABLE 7.6

COMPARISON OF DISABILITY LEVELS OF SAMPLE OF 72 DEPENDENT ELDERLY MEN AND WOMEN IN THE COMMUNITY : CARER ASSESSMENT

	Men	Women	All
age	77	81	80
mobility	2.41	2.11	2.22
vision	1.85	1.87	1.86
hearing	1.74	1.62	1.67
urinary incontinence	1.67	1.71	1.69
use of catheter	1.04	1.04	1.04
bowel incontinence	1.26	1.40	1.35
mental capacity	2.30	2.02	2.13
dress	1.67	1.49	1.56
feed	1.78	1.51	1.61
bath	2.78	2.71	2.74
wash	1.30	1.16	1.21
toilet	3.04	2.36	2.61
pressure area care	1.11	1.13	1.12
getting up	1.52	1.20	1.32 **
going to bed	1.56	1.27	1.38 *
number	27	45	72

* significant at the 0.05 level
** significant at the 0.01 level

7.4.2 Direct Nursing Care

For each patient, the start and finish times on the log sheets were translated into task times, weighted by the number of nurses involved and summed to give the amount of direct nursing care in minutes received by the patient in 24 hours. The mean values of direct nursing care for each mode of care and for men and women are now compared.

(a) Comparison between Modes of Care

The mean direct care times for each sample of patients are shown in Table 7.7. The mean care time for the long-stay public hospital patients was 140 minutes. This was substantially more than the mean of 96 minutes for the long-stay private hospital patients. The difference was highly significant (p =0.0001) and signifies that the public hospital patients were on average heavier consumers of nursing care.

TABLE 7.7

DIRECT NURSING CARE RECEIVED BY PATIENTS IN PUBLIC AND PRIVATE GERIATRIC HOSPITALS

	Direct Care Time (minutes in 24 hours)				
Sample	Mean	Standard deviation	Minimum	Maximum	Number in Sample
public (long-stay)	140	71	15	321	117
private (long-stay)	96	74	5	306	61
private (short-stay) (community sample)	68 (61)	47 (40)	1 (2)	249 (192)	138 (72)

The short-stay patients had a mean care time of 68 minutes which was significantly less (p = 0.0013) than the mean of the long-stay private hospital patients. This is not an unexpected result since it is likely that the short-stay (community based) patients are able to live at home on account of their more modest nursing requirements. The mean care time for the community sample (61 minutes) was not significantly different from that of the full sample of short-stay patients.

The results of these comparisons between the samples, on the consumption of direct nursing care, are consistent with the dependency differences found in 7.4.1 and indicate a relationship between direct nursing care and patient disability.

In both public and private hospital, a large variation in care times was recorded. For the long-stay patients, the range of observed care times in each type of hospital was similar, and the standard deviation was over 70 minutes. The distribution of care times (figures 7.1 and 7.2) show substantial numbers of long-stay patients with care times far from the mean. The means by themselves are not sufficient descriptors of the samples of long-stay patients as a whole, particularly in the case of the private hospital sample, for which the care time distribution was positively skewed (figure 7.2).

The distribution of care times for the short-stay patients (figure 7.3) was positively skewed. Again a large range of care times was observed but the standard deviation was at, 47 minutes, less than that of either of the long-stay patient samples. It was shown above that on average the short-stay patients consumed significantly less nursing time than did the long-stay patients. Comparison of the distribution of short-stay patients (figure 7.3) with those of the long-stay patients (figures 7.1 and 7.2) shows that there is considerable overlap of the consumption of direct nursing care of the two types of patient.

The mean direct care time for the patients in the community sample was compared to that for the other 68 short-stay patients (see Table 7.8). The care time for the community sample was lower but the difference was not significant ($p = 0.0863$).

Thirteen of the 72 patients in the community sample had entered long-stay care by the time of the data collection in the community. It could be hypothesized that these patients would require more nursing care than those who continued to live at home. This was tested using data on

Figure 7.1

DISTRIBUTION OF DIRECT NURSING CARE TIME
OF LONG-STAY PATIENTS IN PUBLIC GERIATRIC HOSPITAL

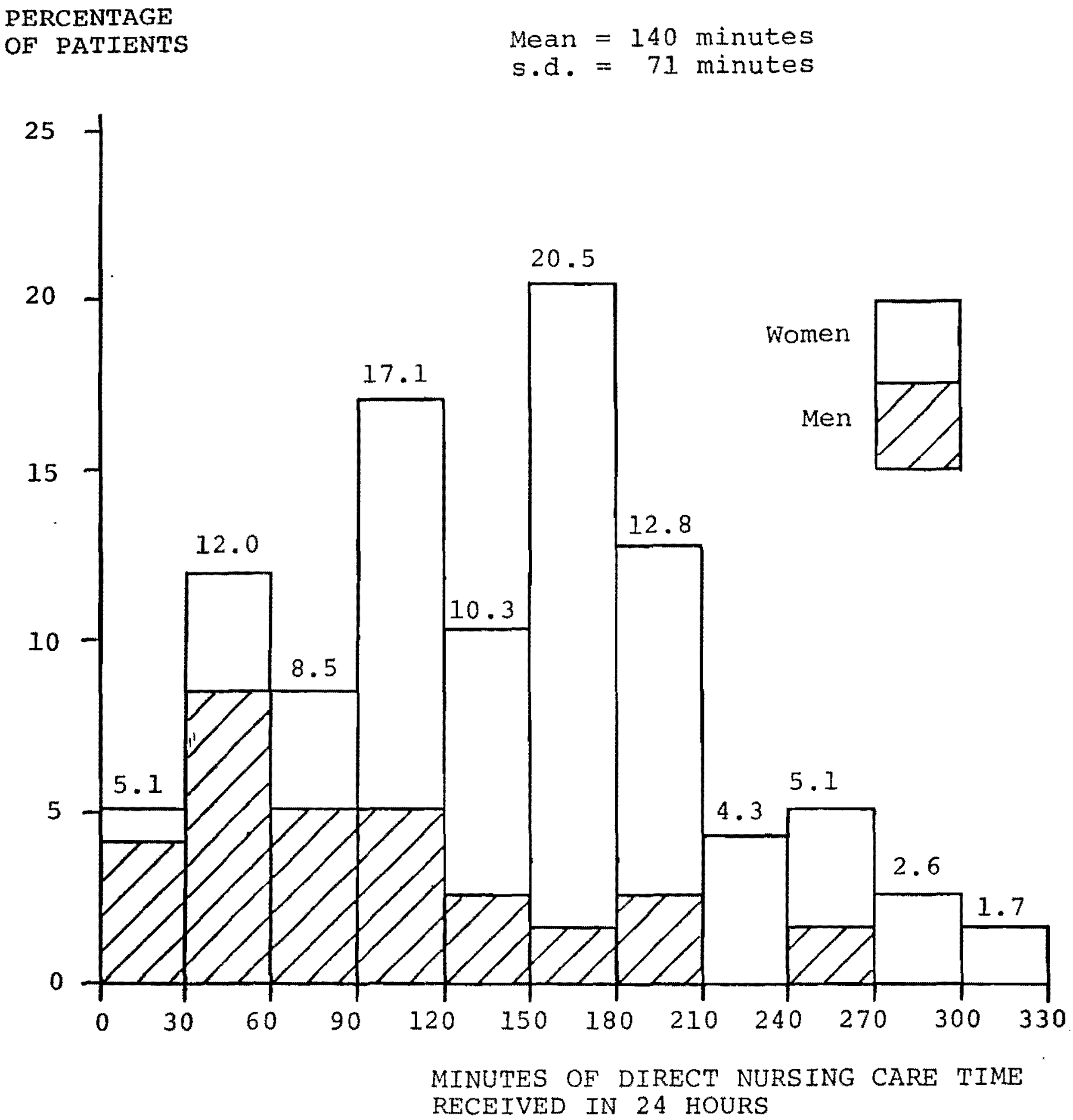


Figure 7.2

DISTRIBUTION OF DIRECT NURSING CARE TIME OF LONG-STAY PATIENTS IN PRIVATE GERIATRIC HOSPITALS

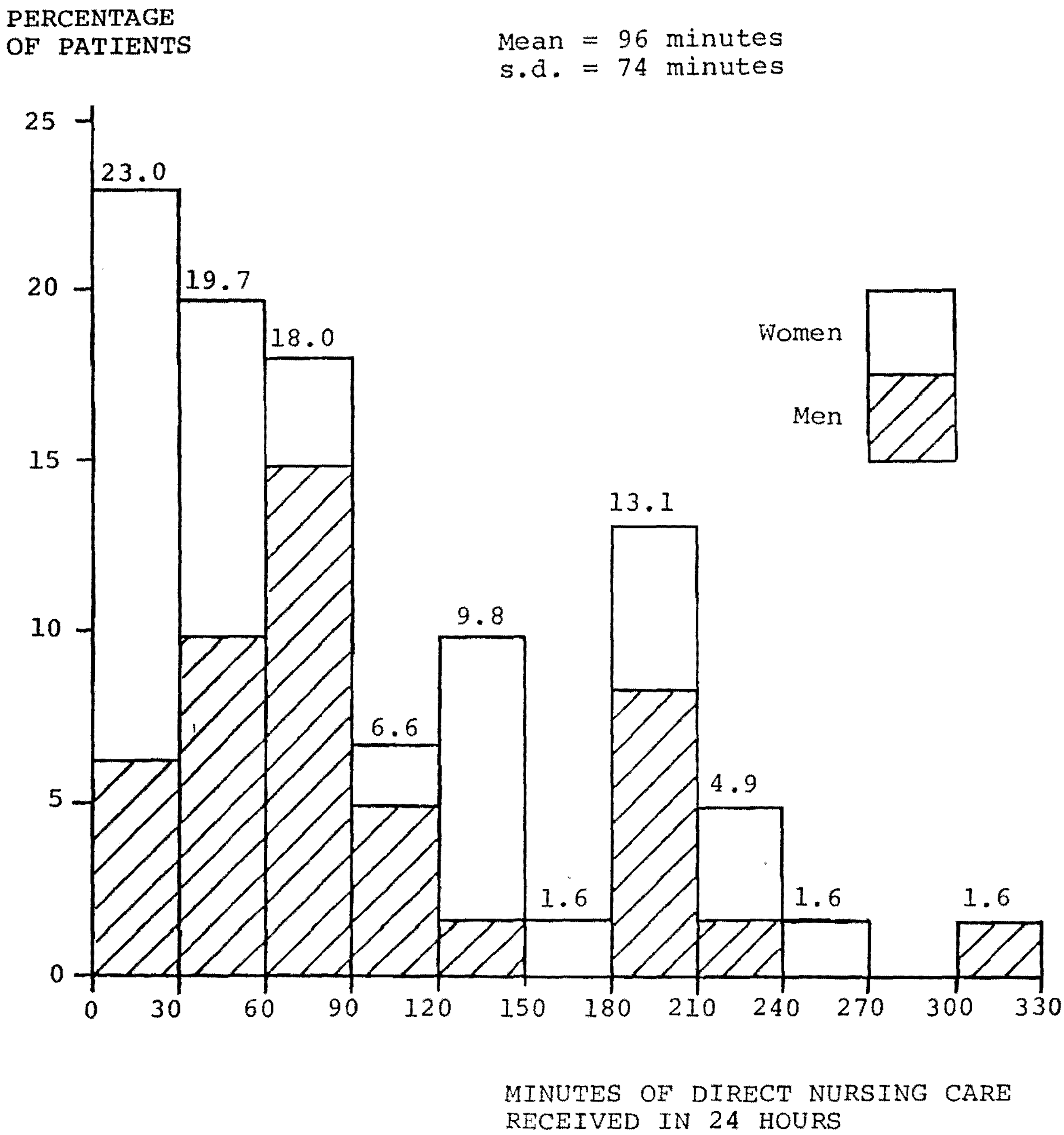


Figure 7.3

DISTRIBUTION OF DIRECT NURSING CARE TIME
OF SHORT-STAY PATIENTS IN PRIVATE GERIATRIC HOSPITAL

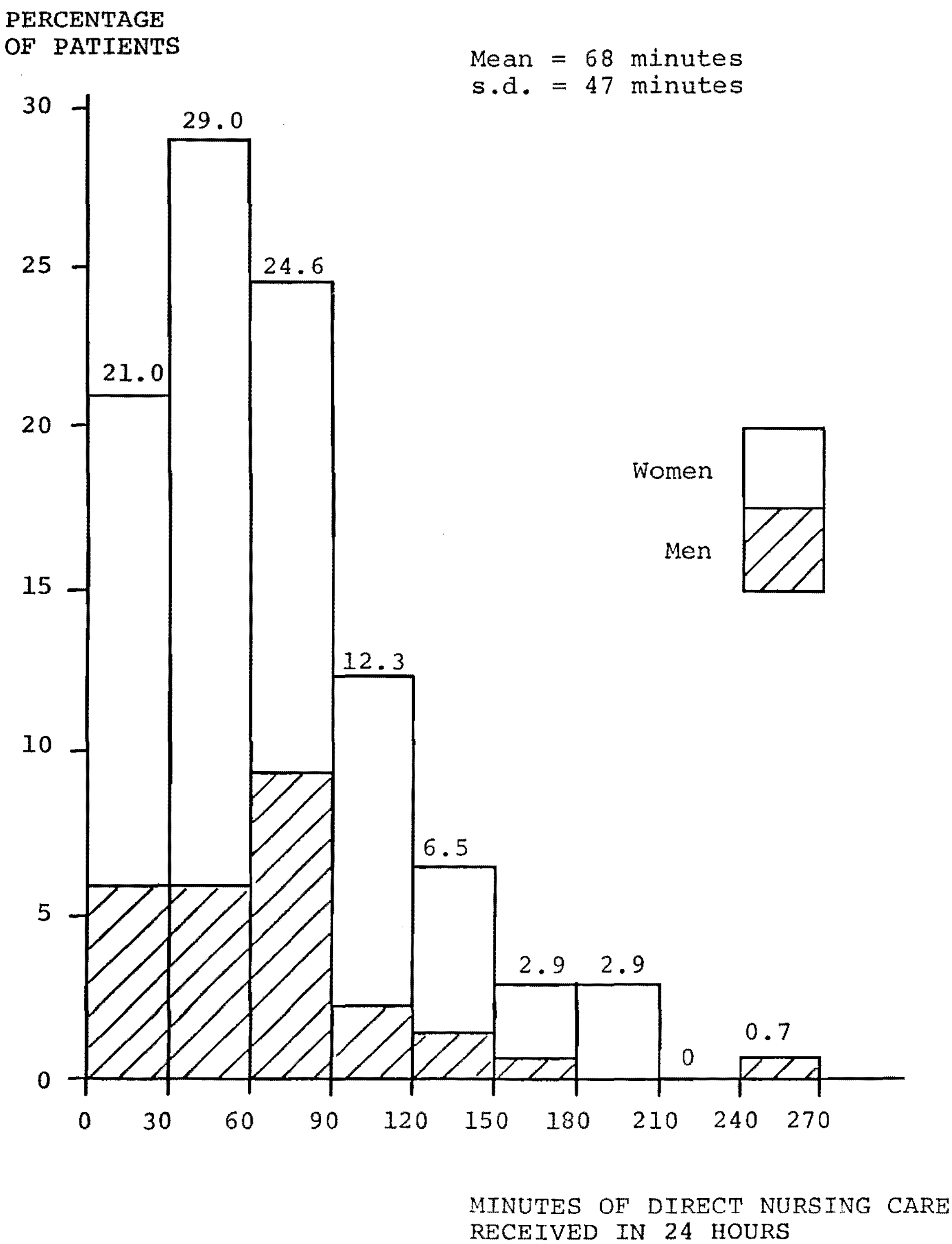


TABLE 7.8

COMPARISON OF DIRECT NURSING CARE OF
COMMUNITY SAMPLE WITH OTHER SHORT-STAY PATIENTS

	Direct care time (mins. in 24 hours)		
	Mean	s.d.	n
Community sample	61	40	70
Other short-stay patients	75	52	68
Total short-stay	68	47	138

TABLE 7.9

COMPARISON OF DIRECT NURSING CARE OF
COMMUNITY SAMPLE BY EVENTUAL LIVING SITUATION

Eventual living situation	Direct care time (mins. in 24 hours)		
	Mean	s.d.	n
In long-stay care	65	49	13
Remaining at home	59	38	59
Total Community sample	61	40	72

nursing care consumed when both groups were in the short-stay hospital (see Table 7.9). Although the mean direct nursing care time for those who had entered long-stay care was numerically higher, the difference was not significant ($p = 0.6476$).

(b) Comparison by Sex

The consumption of direct nursing care was compared for men and women, in each sample. The results are presented in Table 7.10. In public hospital the female patients consumed on average 161 minutes of direct nursing care per day, compared with the male patients' average of 95 minutes.

The difference was highly significant (p = 0.0000). The variation in care time for the men's and women's subgroups were similar. The standard deviation was 66 for the men and 63 for the women (see also Fig. 7.1).

TABLE 7.10

MEAN DIRECT NURSING CARE RECEIVED BY MEN AND WOMEN PATIENTS IN GERIATRIC HOSPITALS

	Direct care time (minutes in 24 hours)					
	Men			Women		
Sample	mean	standard deviation	n	mean	standard deviation	n
public (long-stay)	95	66	37	161	63	80
private (long-stay)	97	73	30	94	77	31
private (short-stay)	64	44	36	69	48	102
(community sample)	(60)	(38)	(27)	(61)	42	(45)

In private hospital there was no significant difference between the mean direct nursing care time of male and female long-stay patients (p = 0.84) or of male and female short-stay patients (p = 0.60). The variation in care times for male and female patients was similar, indicated by the standard deviations, and illustrated in Figures 7.2 and 7.3.

When comparing between the samples, the long-stay women in public hospital consume on average substantially more care time than those in private hospital. There is no significant difference however, between the mean direct nursing care consumption of the long-stay men in public hospital and those in private hospital (p = 0.88). In contrast, the significance of the difference between the (greater) direct nursing care of the long-stay compared to the short-stay private hospital patients holds for both the men ($p = 0.02$) and women ($p = 0.03$) subgroups.

Once more these findings are compatible with the dependency differences found in 7.4.1 and suggest a relationship between direct nursing care and the patient disability measures.

7.5 DISABILITY AND DIRECT NURSING CARE

The mean direct nursing care received in public hospital by patients at each point on the disability scale for each assessment item, is shown in Table 7.11. The mean direct nursing care increases with increasing disability for all assessment items. These results are significant ($p < 0.0005$) for all assessment items apart from vision, hearing and use of catheters. A similar analysis of the mean direct nursing care, by measures of disability, for patients in private hospital (see Table 7.12) shows that again, nursing care increases with disability. In this case the result is significant ($p < 0.0005$) for all assessment items apart from hearing. In both public and private hospital the mean direct nursing care increased with the increasing age of the patient ($p < 0.05$).

The variation in mean direct nursing care over the scores on each disability item shows the importance of measuring disabilities on scales, rather than by zero-one variables as in the Guttman scale used by Wright, Cairns and Snell (1982) or the Katz scale used by Philips (1982).

Medical Diagnosis

Information on medical diagnosis was collected for the patients in the public hospital. The 117 patients had between them a variety of stable and progressive conditions; some patients had two or three diagnoses contributing to their disability. The most frequent main diagnoses were: cardio-vascular arrest - C.V.A. (49 cases), senile dementia (27 cases), nursing care (10 cases) and hemiparesis (6 cases).

Little relationship could be seen between diagnosis and direct nursing care. One or two tentative statements could be made e.g. that patients with hemiparesis consumed small amounts of direct nursing care (mean = 87, s.d. = 52, minutes) and those with senile dementia were high consumers (mean = 189, s.d. = 83, minutes), compared with the overall mean of 140 minutes (s.d. = 71). Patients with C.V.A., the most common diagnosis, consumed a wide variation of nursing care (mean = 129), with a standard deviation of 76 minutes. Similarly, the 10 cases with 'nursing care' had a mean of 138, close to the overall mean, but a standard deviation of 85 minutes, which was larger than the overall standard deviation. Clearly medical diagnosis by itself is not sufficient to predict the nursing care received. It needs to be accompanied by a description of the state or severity of the illness, which is precisely what the disability and functional capacity measures: mobility, toileting, etc. set out to do.

In the next section, (7.6), the disability measures are used as independent variables in regression models to explain the variation in direct nursing care.

TABLE 7.11

MEAN DIRECT NURSING CARE BY MEASURES OF DISABILITY FOR 117 PUBLIC GERIATRIC HOSPITAL PATIENTS

	Direct Nursing Care (mins. in 24 hours)				
	Mean	s.d.	n	F	Significance
Age					
-64	96.08	52.36	12		
65-69	104.28	67.87	18		
70-74	150.17	60.70	12	3.09	0.0080
75-79	122.15	64.93	13		
80-84	172.04	77.40	28		
85-89	148.65	59.60	20		
90-	153.29	73.72	14		
Mobility					
Walks unaided	52.50	38.56	4		
Walks with aid	49.80	20.08	15		
Mobile in wheel-chair	101.64	58.14	25	25.11	0.0000
Walks with assistant	141.10	50.52	10		
Chairfast	177.07	48.03	56		
Bedfast	218.71	73.93	7		
Mental Capacity					
Not impaired	108.65	71.80	23		
Forgetful	118.52	62.80	23		
Confused	163.79	64.53	38	6.08	0.0002
Disturbed	123.83	63.20	23		
Unresponsive	205.90	64.43	10		
Urinary Incontinence					
Continent	91.56	74.74	27		
Accidents	112.45	58.65	22	16.75	0.0000
Night Incontinence only	117.00	50.69	8		
Incontinent	174.57	57.08	60		
Bowel Incontinence					
Continent	110.95	70.66	42		
Accidents	109.36	56.39	25	17.30	0.0000
Incontinent	179.24	58.34	50		
Vision					
Good	136.75	76.55	24		
Fair	133.37	69.87	62		
Poor	157.67	81.31	21	0.66	0.5769
Blind	147.00	62.23	2		
Cannot be Determined	150.00	25.50	8		

TABLE 7.11 (continued)

	Direct Nursing Care (mins. in 24 hours) Mean	s.d.	n	F	Significance
Hearing					
Good	124.89	64.27	46		
Fair	145.44	74.25	45		
Poor	163.00	80.51	15	1.36	0.2582
Deaf	125.00	64.02	6		
Cannot be Determined	174.20	65.19	5		
Dressing					
Unaided	39.00	40.26	5		
Needs help with some items	81.70	49.48	33		
Needs full help (1)	168.42	59.34	64	8.23	0.0000
Needs full help (2)	179.07	52.95	15		
Feeding					
Unaided	89.60	58.85	35	40.43	0.0000
Food cut up	119.68	61.22	37		
Is fed	195.38	44.92	45		
Bathing					
Unaided	17.67	3.79	3		
Help in/out	58.75	35.70	4	9.46	0.0000
Is bathed (1)	132.75	69.04	75		
Is bathed (2)	174.63	56.86	35		
Washing					
Unaided	70.59	56.76	32		
Needs help (1)	163.82	56.60	82	34.61	0.0000
Needs help (2)	221.33	43.66	3		
Toileting					
Unaided	82.50	38.89	2		
Commode/urinal	42.33	27.38	15		
Day help	58.50	27.75	6	28.78	0.0000
Night help	68.50	43.38	4		
Always help (1)	119.43	50.33	21		
Always help (2)	180.04	51.73	69		
Pressure Area Care					
Not required	62.09	39.86	22		
Light (1)	116.94	64.93	33		
Heavy (1)	187.00	23.38	4	20.91	0.0000
Light (2)	172.00	44.16	18		
Heavy (2)	182.17	57.98	40		

TABLE 7.11 (continued)

	Direct Nursing Care (mins. in 24 hours) Mean	s.d.	n	F	Significance
<u>Uses Catheter/Uridome</u>					
No	137.69	72.87	101	0.65	0.4230
Yes	153.06	57.38	16		
<u>Getting Up</u>					
Unaided	31.33	16.99	6	52.92	0.0000
Needs help (1)	83.39	49.84	36		
Needs help (2)	175.55	53.81	75		
<u>Going to Bed</u>					
Unaided	28.75	13.37	8		
Needs help (1)	81.82	40.61	33	65.85	0.0000
Needs help (2)	176.66	53.76	76		

(1), (2) The numbers in backets refer to the number of persons needed to help with the care task.

TABLE 7.12

MEAN DIRECT NURSING CARE BY MEASURES OF DISABILITY FOR 199 PRIVATE GERIATRIC HOSPITAL PATIENTS

	Direct Nursing Care (Mins. in 24 hours)				
	Mean	s.d.	n	F	Significance
Age					
60-64	56.50	44.98	5		
65-69	95.44	67.25	9		
70-74	68.11	55.37	36		
75.79	62.65	54.41	37	2.22	0.0431
80-84	69.54	38.87	46		
85-89	102.31	74.55	39		
90-	77.04	56.95	27		
Mobility					
Walks unaided	43.00	31.19	52		
Walks with aid	60.33	40.50	85		
Mobile in Wheel-chair	50.00	45.51	3	32.65	0.0000
Walks with assistant	105.03	46.49	29		
Chairfast	137.90	61.24	21		
Bedfast	191.56	64.28	9		
Mental Capacity					
Not impaired	60.13	52.72	108		
Forgetful	91.00	54.95	32	10.24	0.0000
Confused	84.60	52.06	43		
Disturbed	133.50	68.04	16		
Urinary Incontinence					
Continent	58.68	45.56	142		
Accidents	98.39	56.58	31	37.97	0.0000
Incontinence	146.04	60.13	26		
Bowel Incontinence					
Continent	64.45	48.05	163		
Accidents	119.34	64.76	29	26.78	0.0000
Incontinent	173.43	71.41	7		
Vision					
Good	60.56	53.74	95		
Fair	86.15	52.64	82	8.45	0.0003
Poor	107.41	74.33	22		

TABLE 7.12 (continued)

	Direct Nursing Care (mins. in 24 hours) Mean	s.d.	n	F	Significance
Hearing					
Good	69.94	59.43	112		
Fair	84.68	56.95	71	1.55	0.2155
Poor	83.44	48.52	16		
Dressing					
Unaided	32.48	21.56	71		
Needs help (1)	95.39	51.18	122	72.19	0.0000
Needs help (2)	206.17	81.69	6		
Feeding					
Unaided	55.62	39.19	132		
Food cut up	100.89	58.48	53	52.91	0.0000
Is Fed	177.93	63.66	14		
Bathing					
Unaided	33.95	28.00	20		
Help in/out	46.44	29.64	77	43.19	0.0000
Is bathed (1)	87.80	48.93	64		
Is bathed (2)	139.63	67.15	38		
Washing					
Unaided	60.19	42.53	161		
Needs help (1)	137.12	64.37	34	53.90	0.0000
Needs help (2)	207.00	30.30	4		
Toileting					
Unaided	36.82	24.57	89		
Commode/urinal	76.57	34.51	7		
Day help	71.78	20.25	9	79.45	0.0000
Night help	69.33	28.96	24		
Always help (1)	103.43	39.00	49		
Always help (2)	189.95	55.47	21		
Pressure Area Care					
Not required	55.88	39.78	146		
Light (1)	109.03	54.96	33	40.03	0.0000
Heavy (1)	132.71	47.93	7		
Light (2)	168.57	48.87	7		
Heavy (2)	219.17	44.59	6		
Uses Catheter/Uridome					
No	72.62	53.89	188	14.53	0.0002
Yes	138.91	87.20	11		

TABLE 7.12 (continued)

	Direct Nursing Care (mins. in 24 hours) Mean	s.d.	n	F	Significance
Getting Up					
Unaided	32.15	24.79	64		
Needs help (1)	83.10	44.40	101	64.33	0.0000
Needs help (2)	139.09	70.82	34		
Going to Bed					
Unaided	41.85	35.25	87		
Needs help (1)	84.22	38.01	89	100.44	0.0000
Needs help (2)	175.78	65.45	23		

(1), (2) The numbers in brackets refer to the number of persons needed to help with the care task.

7.6 MODELLING THE RELATIONSHIP BETWEEN DIRECT CARE TIME AND PATIENT DISABILITY MEASURES

7.6.1 Introduction

The purpose of the following analysis is to determine whether the variation in direct nursing time can be explained in terms of patient characteristics; to assess the relative importance of each characteristic as a determinant of the amount of care received and to develop models which can be used to predict the amount of direct nursing care consumed by a patient from information on the patient's characteristics. The patient characteristics are each measured on a scale to improve predictive ability, and the dependent variable to be explained is TNTIME, the measured amount of direct nursing time received by a patient.

Statistical techniques are used to assess the models. The assumptions of the estimating procedures are tested and where violations occur, modifications are made in order to develop valid models. The limitations and predictive ability of the models are examined and the robustness of their applicability to different subgroups of the samples i.e. long and short-stay and male and female patients, is tested.

Separate analyses are presented for private and public hospital patients.

7.6.2 Private Hospital Patients

(a) Observations

A total of 199 observations (138 short-stay patients and 61 long-stay patients) were obtained in the private hospitals and the regression analyses are based on this data set.

(b) Variables

(i) Dependent Variable

The dependent variable was TNTIME, the amount of direct nursing (in minutes) received by a patient over a 24 hour period. The mean value of direct nursing care was 76 minutes and the standard deviation was 58 minutes, for the 199 patients.

(ii) Explanatory Variables

Fifteen patient characteristics measured on the dependency form (see Table 7.1 and Appendix 1) were included[4] as explanatory variables. In addition, variables representing the sex and type of patient were used, and also a variable (BHELP) indicating if a bath had been given on the day when nursing care was monitored.[5] These variables are listed below together with the ranges of their values. They include functional capacity measures (variables X_4-X_{10}) and disability measures (variables X_{11}-X_{15}).

---

4 Medical Diagnosis was not included.

5 This variable was required because bathing may increase the daily care time for some patients and because baths were not given each day.

X_1	AGE	in years
X_2	SEX(HOSP)[6]	1. male 2. female
X_3	TYPE	1. short-stay 2. long-stay
X_4	MOBILITY	(1-8)
X_5	VISION	level of vision with glasses if worn (1-3)
X_6	HEARING	(1-3)
X_7	INCONT	urinary incontinence (1-3)
X_8	BINC	bowel incontinence (1-3)
X_9	CATH	dummy variable indicating use of catheter or uridome (1-2)
X_{10}	MENTAL	mental capacity (1-4)
X_{11}	DRESS	ability to dress (1-3)
X_{12}	FEED	ability to eat (1-3)
X_{13}	BATH	ability to bath or shower (1-4)
X_{14}	WASH	ability to wash hands and face (1-3)
X_{15}	TOILET	ability to use a toilet or commode, day and night (1-8)
X_{16}	PACARE	need for pressure area care (1-5)
X_{17}	WEIGHT	dummy variable indicating if patient over-weight (1-2)
X_{18}	BHELP	dummy variable indicating if shower/bath given on day of monitoring care (1-2)

---

6 HOSP is the hospital code. The variables SEX and HOSP in this analysis amounted to the same thing except in the case of three men admitted to the women's hospital. Only one of these two variables can be used in a particular analysis.

(c) The Model

A linear[7] relationship was postulated between TNTIME, the direct nursing care time received by a patient in 24 hours and the explanatory variables X_1 X_2 ... X_{18}, measuring patient characteristics.

$$\text{TNTIME} = \beta_o + \sum_{i=1}^{18} \beta_i X_i + \varepsilon \tag{7.1}$$

(d) Analysis and Interpretation

(i) Ordinary Least Squares

Using ordinary least squares regression analysis on the full sample, coefficients $\{b_i\}$, estimates of $\{\beta_i\}$, were obtained. These are shown in Table 7.13.

The model explained 75.2 percent of the variation in nursing care times. Tests of significance of all the coefficient estimates were made. All tests (with the exception of those for AGE, SEX, TYPE and CATH) were one tail rather than two, since a priori, the coefficients should be positive.

Six variables: MENTAL DRESS WASH TOILET PACARE and BHELP had highly significant coefficients (significance $<.01$). Two variables MOBILITY and FINC were barely significant ($p <.10$). The remainder were not significant.

Stepwise regression on the full sample yielded the set of significant independent variables (shown in Table 7.14) (variable BINC became insignificant and was removed.)

---

7 Multiplicative models were tested and found to have much less explanatory power.

TABLE 7.13

RESULTS OF ORDINARY LEAST SQUARES REGRESSION OF DIRECT NURSING TIME ON ALL EXPLANATORY VARIABLES - PRIVATE HOSPITAL DATA

Explanatory variable	Coefficient estimate b	Standard error	t	
CONSTANT	-87.05			
AGE	0.074	0.320	0.230	
HOSP (=SEX) †	-1.697	5.551	-0.305	
TYPE	6.690	5.214	1.283	
MOBILITY	3.901	2.497	1.562	*
VISION	1.899	3.816	0.497	
HEARING	1.436	4.048	0.353	
INCONT	-5.046	4.577	-1.102	
BINC	8.652	5.857	1.477	*
CATH	-4.324	11.188	-0.386	
MENTAL	8.135	2.423	3.357	**
DRESS	17.749	5.651	3.141	**
FEED	5.673	5.157	1.100	
BATH	-0.811	3.573	-0.228	
WASH	18.227	6.467	2.818	**
TOILET	8.433	1.549	5.446	**
PACARE	10.010	3.757	2.664	**
WEIGHT	5.681	6.044	0.940	
BHELP	11.255	4.703	2.393	**

R^2, coefficient of determination = 0.752
** significant at the 0.01 level (1 tail test)
* significant at the 0.10 level (1 tail test)
† when HOSP was replaced by SEX the coefficient estimate was -1.67 and was not significant (t value was -0.221).

All coefficients have significant positive coefficients and this seven variable model accounts for 74 percent of the variation in nursing time. Removing all non-significant variables has resulted in a loss of only one percent of the explanatory power of the model.

The seven variable model can be used to predict the direct nursing care time of each of the 199 patients, from the values of the seven explanatory variables.

The standard deviation of the prediction error for a particular patient varies according to the values of the

TABLE 7.14

SIGNIFICANT REGRESSION COEFFICIENTS FROM STEPWISE REGRESSION - PRIVATE HOSPITAL DATA

Explanatory Variable	Coefficient estimates b	Standard error	t
TOILET	8.452	1.410	5.995 **
PACARE	11.127	3.320	3.351 **
MENTAL	9.046	2.219	4.077 **
DRESS	17.294	5.349	3.233 **
WASH	19.418	6.195	3.134 **
BHELP	12.284	4.406	2.788 **
MOBILITY	4.723	2.278	2.074 *
CONSTANT	-66.436		

** significant at the .005 level (1 tail test)
* significant at the .025 level (1 tail test)
$R^2 = .741$

explanatory variables (i.e. the disability level of the patient) taking its lowest value at the means (i.e. mean disability levels).

Table 7.15 shows the predictions at the lowest, mean and highest level of dependency, with the associated standard deviations (s.d.)

TABLE 7.15

PREDICTED CARE TIMES AT DIFFERENT LEVELS OF DEPENDENCIES - PRIVATE HOSPITAL DATA

	Dependency lowest	mean	highest
Predicted care time (mins)	15.91	76.28	256.05
s.d. of predictor (mins)	4.37	2.13	11.08
s.d. of prediction error (mins)	30.31	30.07	31.98

The second line of Table 7.15 refers to the error in predicting the care time of the average patient of a particular dependency and is due to the error in the estimates of the model coefficients.

The last line of Table 7.15 refers to the error in predicting the care time of an individual patient of a particular dependency. This standard deviation is made up of two parts: the error in the estimates of the model coefficients (line 2), and the inherent variability in the care times for patients at any given level of dependency. The latter is the main cause of the prediction error.

These figures show that the level of accuracy of prediction for an individual patient remains the same throughout the range of level of dependency. With 95 percent certainty the prediction is the calculated value plus or minus 60 minutes (2 x s.d.). This error is disturbingly high at the lower range of dependency where predictions are less than 30 minutes.

One of the assumptions of the estimation procedure used (ordinary least squares) is that of homoscedastic errors i.e. that the variation in the dependent variable (TNTIME), is the same for any given level of dependency of the patient. However there are good reasons for believing that this is not the case and the apparent high standard errors of predictions demonstrate the unrealistic nature of this assumption.

The variation in total direct care time for a patient arises as the sum of the variation in times required to do the many tasks i.e. feeding, washing, toileting, etc., which the particular patient cannot do independently. It is reasonable to suppose that the more there are of these tasks then the greater the resulting variation will be in the total direct care time. The direct care times of the more dependent patients will therefore be more variable than those of the less dependent patients, violating the assumption of homoscedasticity. This view was supported by the nursing staff who observed that their more independent patients were very much the same from day to day. It was also substantiated by data collected on a sample of patients who were each monitored several times.

When the assumption of homoscedasticity does not hold, the resulting estimates of the coefficients $\{b_i\}$ remain unbiased but their standard errors are biased. Therefore the tests of significance are invalid. Since this is the basis upon which variables are included in or excluded from the model, the type of heteroscedasticity must be determined and the model re-estimated.

Because the variances of the heteroscedastic errors were unknown it was necessary to find a variable to which they were related before the model could be transformed for re-estimation. Plotting the residuals against X_{15} (TOILET) incidated it to be a likely candidate. A test for heteroscedasticity (Goldfeld and Quandt, 1965) with respect to this variable was significant (F_{56}^{54}=8.45, which is significant at the one percent level).

The Glejser test (Glejser, 1969) showed the absolute value of the residuals to be related to various functions of the variable X_{15} (see Table 7.16).

TABLE 7.16

RESULTS OF SEPARATE REGRESSIONS OF THE ABSOLUTE VALUE OF THE RESIDUALS ON VARIOUS REGRESSORS (DIFFERENT FUNCTIONS OF X_{15}) - PRIVATE HOSPITAL DATA

Regressor	Constant	Coefficient	R^2	t
X_{15}	11.526	3.167	.175	6.47*
X_{15}^2	15.063	.397	.190	6.80*
$\sqrt{X_{15}}$	3.412	11.081	.162	6.16*

* All values of t were significant at the 1 percent level.

The problem of heteroscedasticity can be overcome by transforming the model so that the resultant errors become homoscedastic. The transformed model is re-estimated using ordinary least squares. This procedure is equivalent to using weighted least squares.

Two transformations were tried:

(1) dividing the model equation by X_{15}

(2) dividing the model equation by $\sqrt{X_{15}}$.

In each case the model was re-estimated and the Goldfeld-Quandt test was made. The result of case (1) was that heteroscedasticity still existed but of a different form viz. less dependent patients were more variable than the heavily dependent patients. In case (2) the transformed model did not exhibit heteroscedasticity (F^{54}_{56} = 1.289 which is not significant at the 5 percent level). This second model is therefore adopted in the subsequent analysis.

(ii) Weighted Least Squares

The model:

$$\frac{TNTIME}{\sqrt{X_{15}}} = \frac{\beta_o}{\sqrt{X_{15}}} + \sum_{i=1}^{18} \beta \frac{X_i}{\sqrt{X_{15}}} + \nu \qquad (72)$$

where $\nu = \dfrac{\varepsilon}{\sqrt{X_{15}}}$,

has approximately homoscedastic errors and hence can be estimated using ordinary least squares. Applying this technique to all the variables the following coefficients were obtained (see Table 7.17).

Six variables (MENTAL, DRESS, WASH, TOILET, PACARE, BHELP) which were significant in the original untransformed model are again significant. Variable MOBILITY is not. An additional variable HOSP representing the hospital (and indirectly the sex of the patient) is now indicated as an important determinant of nursing care.

Three disability variables: DRESS, WASH and TOILET were significant. These measure disabilities in performing essential

TABLE 7.17

RESULTS OF WEIGHTED LEAST SQUARES REGRESSION OF NURSING TIME ON ALL EXPLANATORY VARIABLES (TRANSFORMED MODEL) - PRIVATE HOSPITAL DATA

Variable	Coefficient estimates,b	standard error	t
CONSTANT	-55.661	26.453	-3.576 **
AGE	0.226	0.251	0.902
HOSP	-12.982	4.167	-3.116 **
TYPE	-0.593	3.791	-0.157
MOBILITY	3.505	2.396	1.463
VISION	4.724	2.989	1.580
HEARING	3.545	3.247	1.092
INCONT	-1.360	4.874	-0.279
FINC	1.315	6.486	0.203
CATH	-11.632	13.980	-0.832
MENTAL	7.600	1.915	3.969 **
DRESS	17.101	4.134	4.136 **
FEED	1.787	5.083	0.352
BATH	-2.219	2.770	-0.801
WASH	14.559	7.048	2.066 *
TOILET	9.442	1.583	5.962 **
PACARE	11.866	4.621	2.568 **
WEIGHT	5.830	4.654	1.253
BHELP	10.504	3.568	2.943 **

Proportion of variation in TNTIME explained by the model = .739
** Significant at the .01 level (1 tail test, except for HOSP)
* Significant at the .05 level (1 tail test).

self-care tasks; increased disability in these areas increases the demand for care time. Variable TOILET by itself explained 61 percent of the variation in care time. PACARE measures the need for pressure area care which arises from poor mobility. This was identified by the nursing staff as a heavy user of their time and the model has confirmed its importance.

Only one functional capacity variable, MENTAL, was significant. It is a crude measure and could perhaps be refined but nonetheless indicates that mental incapacity over and above physical incapacity increases the care consumed for private hospital patients.

The significant value for BHELP indicates that nursing time expended on a day when a patient is bathed or showered is significantly more than on a non-bath day.

Variable HOSP has a negative coefficient showing that patients at the women's hospital take less time than at the men's, and this cannot be accounted for in terms of their disabilities.

Eleven variables had insignificant coefficients. Yet for some of these there are strong a priori reasons for inclusion in the model.

The most notable result is the insignificance of most of the functional incapacity measures, particularly mobility and incontinence. These variables are by themselves related to nursing care requirements (see Table 7.12), but their effects are represented by the other variables in the model. For example, poor mobility is expressed in terms of the inability to dress and toilet independently; incontinence is represented by toileting help, particularly under the hospitals' policy of regular toileting of incontinent patients, making them indistinguishable as far as the model is concerned from patients requiring toileting help at their own request.

Since mental incapacity is strongly associated with incontinence ($\chi^2 = 36.5$, which is significant at the 1 percent level), the variable MENTAL may also include some effect of incontinence.

The conclusion is that there is no significant residual effect of these variables on nursing time over and above that explained by the significant variables in the model.

Two disability measures, BATH and FEED were not significant. The hospitals' policy was to supervise the (very few) patients who could bath themselves, hence little nursing time was saved. The insignificance of FEED is more unexpected. However only 14 of the 199 patients required to be fed and these patients were dependent in other ways. The significant variables in the model were sufficient to explain the variation in care times in this data set.

Although in the population at large, dependency increases with age, in the hospital population only the dependent sections of the age groups are present. The insignificance of the AGE coefficient shows that age manifests itself through demand for help in care tasks and does not have a residual effect on the use of the nursing resource.

The model was re-estimated with the significant variables only and the results are shown in Table 7.18.

TABLE 7.18

RESULTS OF WEIGHTED LEAST SQUARES REGRESSION OF NURSING TIME ON THE SIGNIFICANT VARIABLES ONLY (TRANSFORMED MODEL) - PRIVATE HOSPITAL DATA

	Coefficient estimates,b	Standardized Coefficient estimate	Standard error	t
CONSTANT	-31.573			
TOILET	10.354	.393	1.356	7.634 ***
DRESS	19.179	.463	3.783	5.070 ***
MENTAL	6.649	.209	1.825	3.644 ***
PACARE	13.200	.264	4.323	3.054 **
HOSP	-11.944	.262	3.737	-3.196 **
BHELP	10.676	.250	3.526	3.028 **
WASH	12.558	.223	6.871	1.828 *

*** Significant at the 0.001 level (1 tail test)
** Significant at the 0.01 level (1 tail test except for HOSP)
* Significant at the 0.05 level (1 tail test)

The result of an F-test evaluating the contribution of the omitted variables was not significant at the five per cent level [The F value was 1.41 compared with the critical value of 1.83]. This seven variable model explains 72.9 per cent of the variation in care time.

Comparing this model with the untransformed model in Table 7.14, the coefficient estimates of the six common variables have changed. Variable MOBILITY is now excluded, and a new variable HOSP is highly significant and is included in the model.

These changes illustrate the importance of testing the validity of the assumptions of the estimating procedure (in this case ordinary least squares).

The seven variable model was used to predict the direct nursing care time for each of the 199 patients from the values of the explanatory variables. A plot of the predicted values (TPRED) against the observed values (TNTIME) is shown in Figure 7.4. If the predicted values equated with those observed, the points would fall on the 45 degree straight line. Points above the line represent patients for whom the model over-estimated the care time; those beneath represent under-estimates.

Figures 7.5 and 7.6 illustrate the models' performance for the women's and men's hospital and Figures 7.7 and 7.8 represent the long and short-stay patients.

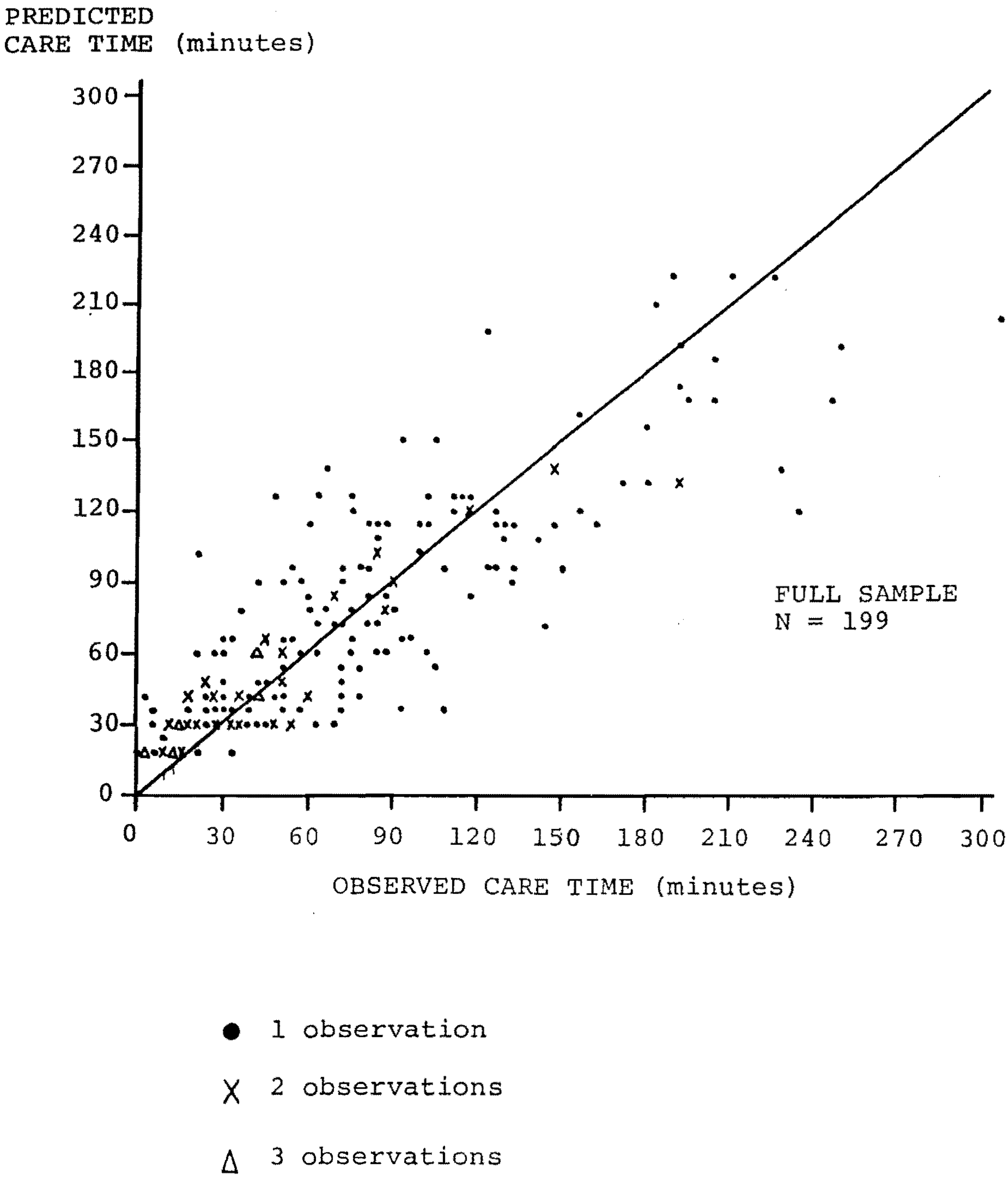
[Note that the prediction errors may appear to indicate heteroscedasticity because the graph is of untransformed data.]

Table 7.19 shows the predicted care time for patients at the lowest, mean and highest dependencies. Two standard deviations (s.d.) are shown: the standard deviation of the predictor and of the prediction error. The first refers to the prediction for the average patient at a particular level of dependency and the second to the prediction for an individ-

Figures 7.4 - 7.8

DIRECT NURSING CARE IN PRIVATE HOSPITAL
PLOT OF PREDICTED AGAINST OBSERVED VALUES

Figure 7.4



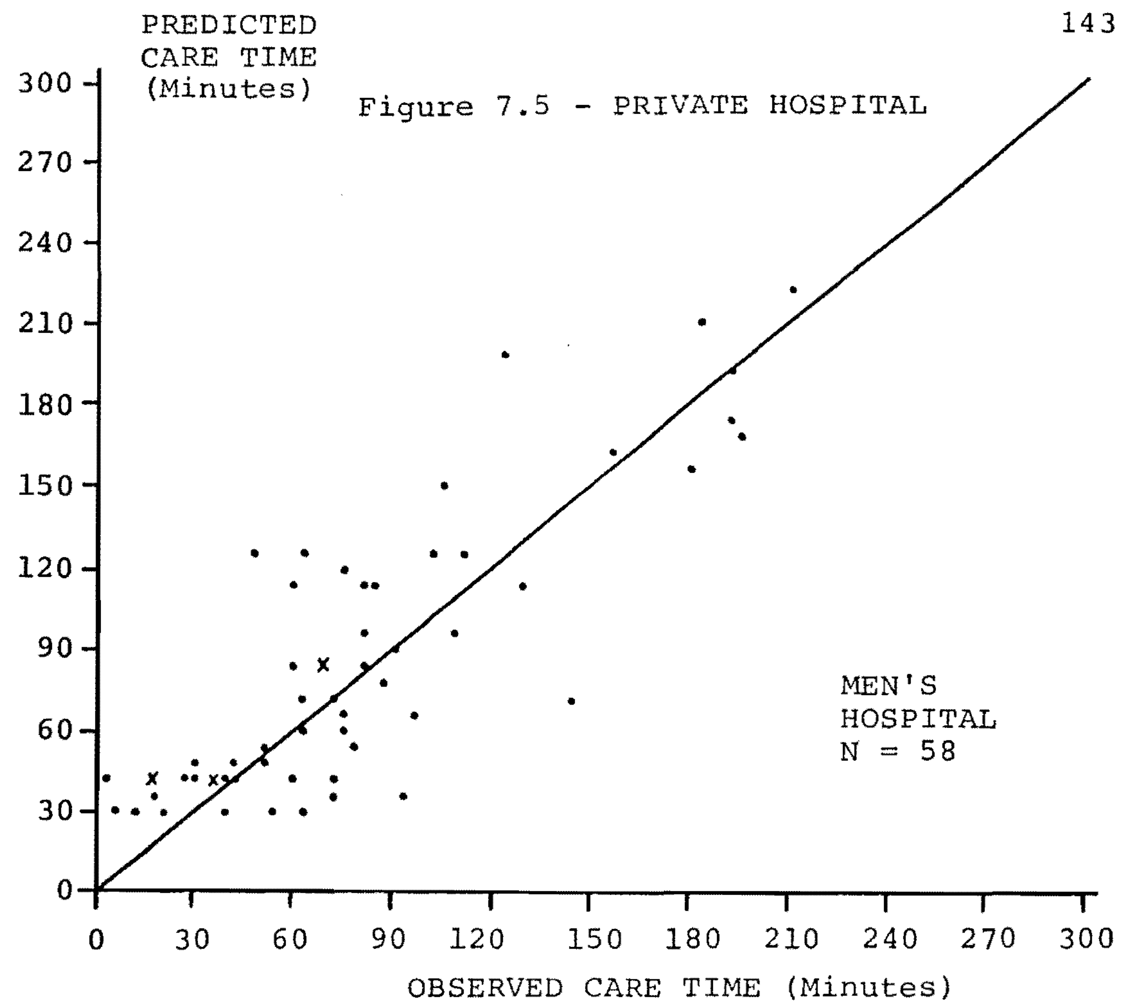


Figure 7.5 - PRIVATE HOSPITAL

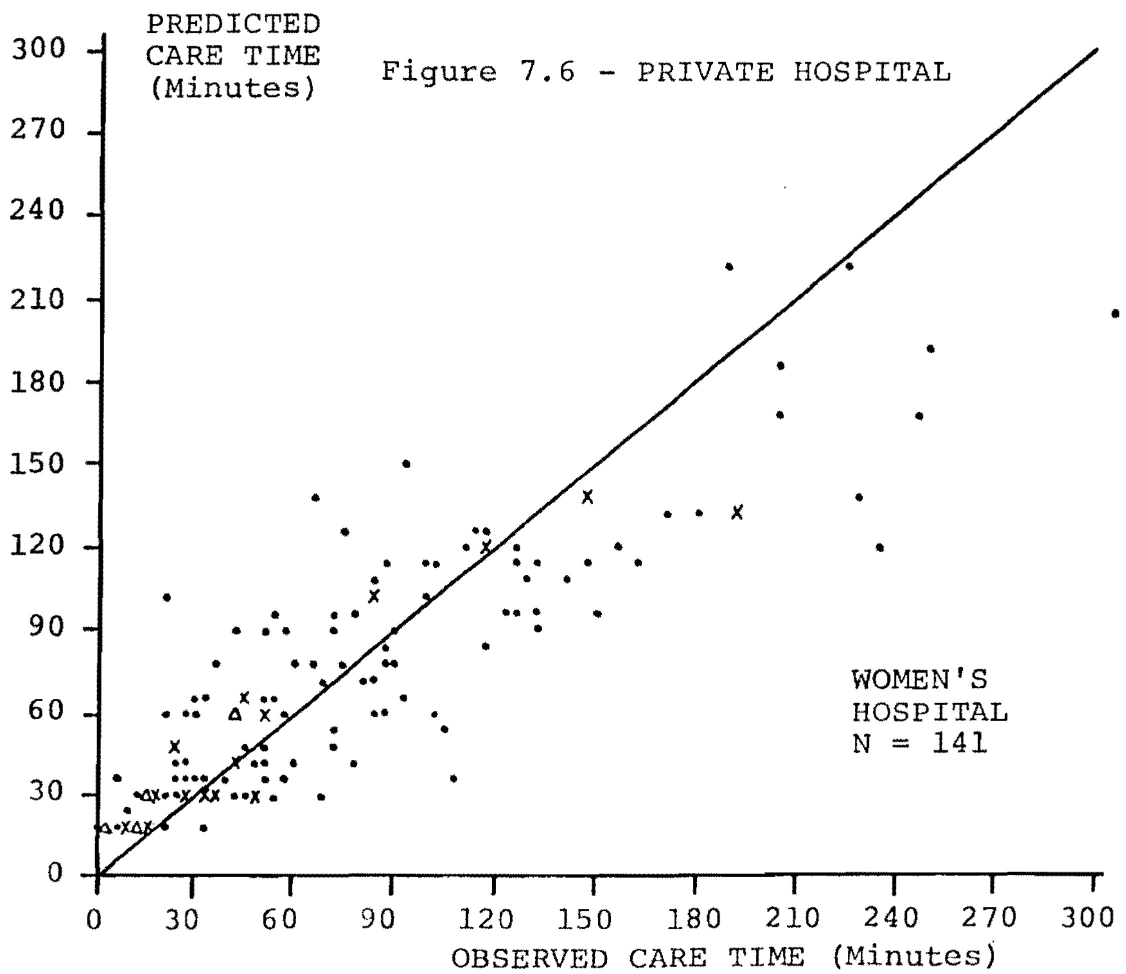
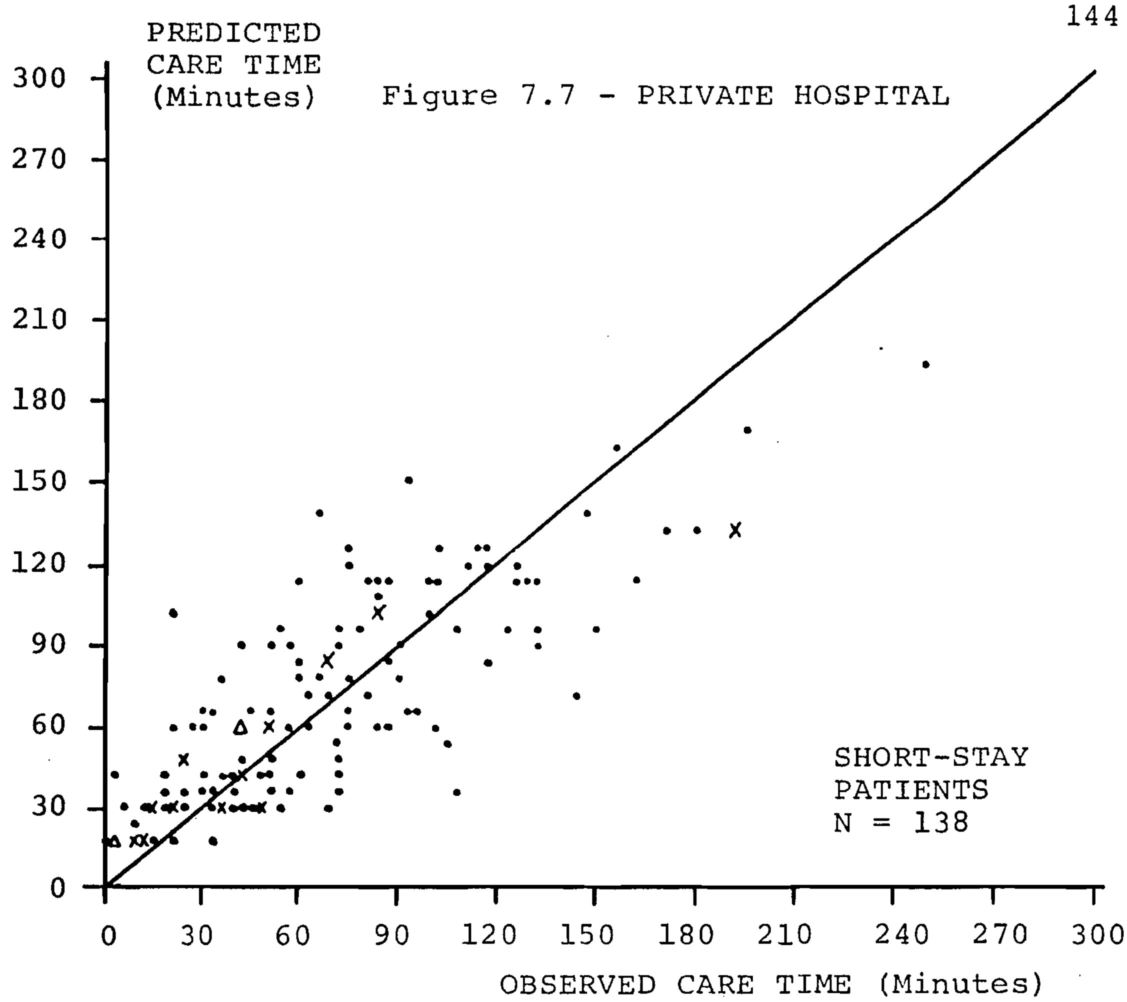
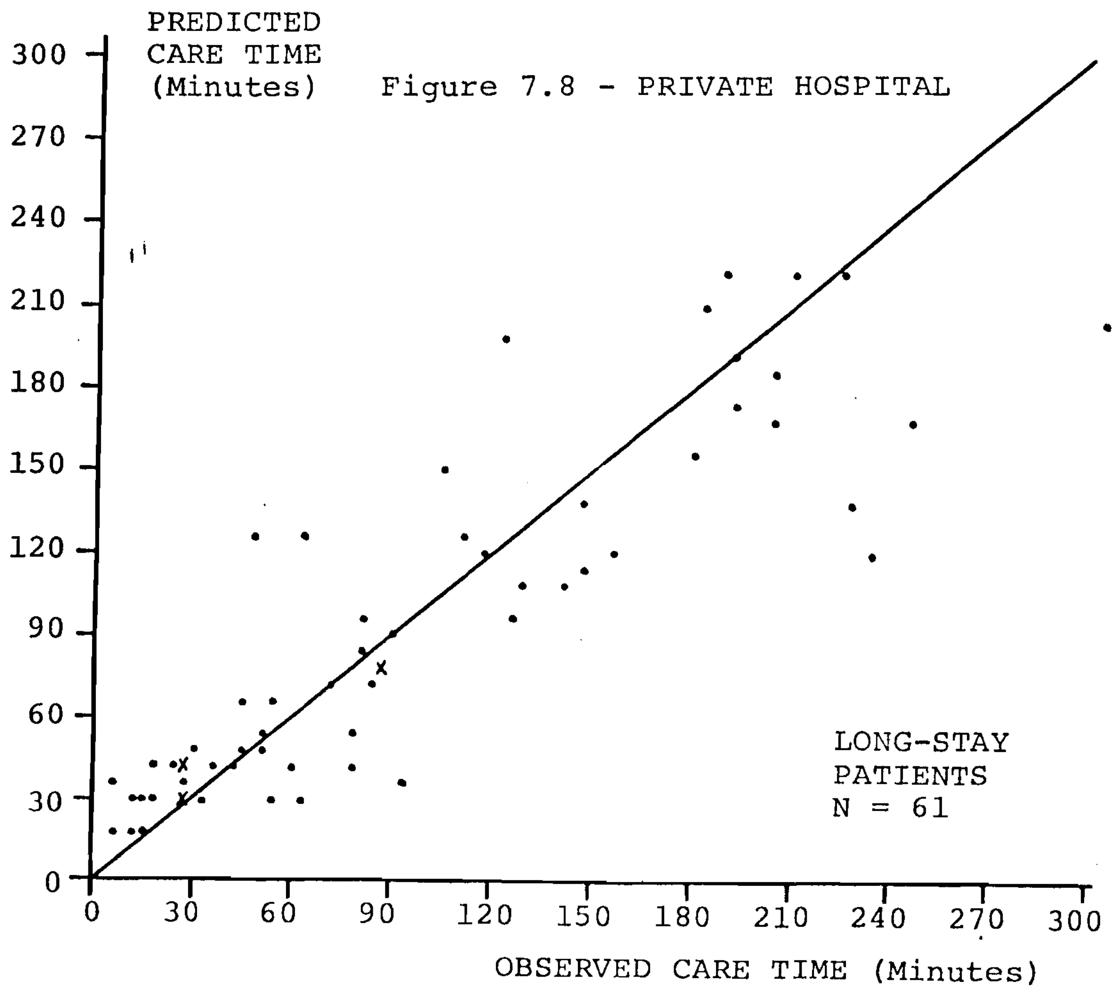


Figure 7.6 - PRIVATE HOSPITAL


PREDICTED
CARE TIME
(Minutes)
Figure 7.7 - PRIVATE HOSPITAL
300
270
240
210
180
150
120
90
60
30
0
0
30
60
90
120
150
180
210
240
270
300
OBSERVED CARE TIME (Minutes)
SHORT-STAY
PATIENTS
N = 138


PREDICTED
CARE TIME
(Minutes)
Figure 7.8 - PRIVATE HOSPITAL
300
270
240
210
180
150
120
90
60
30
0
0
30
60
90
120
150
180
210
240
270
300
OBSERVED CARE TIME (Minutes)
LONG-STAY
PATIENTS
N = 61

ual patient at a particular level of dependency.

TABLE 7.19

PREDICTED CARE TIMES AT DIFFERENT LEVELS OF DEPENDENCIES, USING THE TRANSFORMED MODEL - PRIVATE HOSPITAL DATA

	Lowest	Dependency Mean	Highest
Predicted care time (mins)	20.64	76.28	240.91
s.d. of predictor (mins)	2.85	2.31	13.99
s.d. of prediction error (mins)	18.09	32.71	52.43

When these results are compared with those of the untransformed model in Table 7.15 they show a substantial improvement in prediction error for the less dependent patients. The prediction error is greater for the very dependent patients reflecting the greater inherent variability of these patients.

It should be noted that when predicting the total care time for a number N of patients e.g. a whole ward, the standard deviation becomes relatively smaller, being $\sqrt{n} \times$ s.d. of individual patients. For example for 25 patients all of the highest dependency (the worst case) the standard deviation of total care time is only 5×52.43 which is less than 4½ hours, out of a total predicted care time of 100 hours.

(e) <u>Testing for Model Stability in Subsamples</u>

The seven-variable transformed model was tested for robustness for different subsamples.

(1) Long-stay and short-stay patients

The long-stay patients were a more dependent group than the short-stay. Their mean care time was 96 compared to 67 minutes. The variable TYPE was not significant in the full model indicating that the variables measuring disabilities in the model were sufficient to explain the difference in care time.

However it is useful to ask whether the seven variable model can be applied to both types of patient or whether there is something to be gained from obtaining fresh estimates of the coefficients for each subgroup separately.

The seven variable model which was estimated from the combination of both patient groups (henceforth termed the 'combined model') can be used to obtain predictions of the care times, (TPRED) for each patient in each subgroup. From this the proportion of variation in care time explained for each subgroup can be calculated. These values can be contrasted with the values obtained from separate models estimated for each subgroup (see Table 7.20).

TABLE 7.20

PROPORTION OF VARIATION IN CARE TIME FOR LONG AND SHORT-STAY PATIENTS, EXPLAINED BY THE MODELS - PRIVATE HOSPITAL DATA

	Long-stay	Short-stay
Combined model	.766	.658
Separate models	.799	.673
Number of patients in Subgroup	61	138

Little seems to be gained by using separate models. The Chow test was used to examine this (Chow, 1960). This test compares the residual sums of squares from the combined and separate models using an F ratio. The computed F value was .74 with [8, 183] degrees of freedom which is not significant [the critical value is 2.02 at .05 level of significance]. Hence the separate models do not differ significantly from the combined model.

(2) Men's and Women's Hospitals

The mean care times for the patients in the men's and women's hospitals were 78 and 75 minutes respectively. This appears to contrast with the Scottish Home and Health Department Study (1969) which reports a larger value for women and uses this in the Aberdeen formula as a basis for ward staffing. A re-analysis of the Scottish data by Gault (1982) found that sex was not significant in explaining nursing care when used in a regression model with other independent variables. However the results of the regression show a significant negative coefficient for HOSP indicating less care time for patients in the women's hospital, after allowing for the effects of the other variables in the model. Because of the form of the data it is not possible to determine whether this effect is hospital or sex specific. It could be due to differences in the hospitals and their routines (the men's hospital was older and smaller) or to sex-related differences in care time provision.[8]

A similar analysis to that above was performed for the men's and women's hospital subgroups. The HOSP variable was removed from the separate models for each subgroup, and the results are shown in Table 7.21.

The computed F ratio for the Chow test was 1.407 compared with a critical value of 2.10 ($\alpha = .05$).

---

8 It will be shown in 7.6.3, from a similar analysis of men and women in public hospital that sex is not significant in explaining direct care times. Hence it may be that more direct care time was given in the private men's hospital because staff time was available (an argument put forward by Gault (1982)).

TABLE 7.21

PROPORTION OF VARIATION IN CARE TIME FOR THE MEN'S AND WOMEN'S HOSPITAL SUBGROUPS, EXPLAINED BY THE MODELS - PRIVATE HOSPITAL DATA

	Men's	Women's
Combined model	.669	.746
Separate models	.730	.757
Number of Patients in Subgroup	58	141

The interpretation in this case is that the combined model can be used for each hospital. The difference between the hospitals can be represented by a shift in the constant i.e. by an amount equal to the value of the HOSP coefficient (11.94 mins.). The rest of the model (the six disability variables) does not differ.

7.6.3 Public Hospital Patients

(a) Observations

The full sample of 117 patients (37 men and 80 women) in public hospital care were used in the analysis.

(b) Variables

(i) Dependent Variable

The dependent variable was TNTIME, the amount of direct nursing care received by a patient over a 24 hour period. The mean value of TNTIME was 140 minutes and the standard deviation was 71 minutes, for the 117 patients.

(ii) Explanatory Variables

There were 22 explanatory variables. Seventeen of these were the same[9] as those used in the private hospital model (see 7.6.1). Variable TYPE was not included since only one public hospital patient was short-stay. Five new variables were: WARD, GETUP, GOBED, TRANSFER WANDER.

X_1 AGE in years

X_1 SEX 1. male 2. female

X_3 WARD (1-4)

X_4 MOBILITY (1-6)

X_5 VISION (1-4)

X_6 HEARING (1-4)

X_7 INCONT urinary incontinence (1-3)[9]

X_8 BINC bowel incontinence (1-3)

---

9 The scales for variables INCONT and DRESS for public hospital care were collapsed to align them with the private hospital scales. Categories 3 and 4 for urinary incontinence, and categories 2 and 3 for dressing (see Appendix 1), were combined.

X_9 CATH dummy variable indicating use of catheter or uridome (1-2)

X_{10} MENTAL mental capacity (1-4)

X_{11} DRESS ability to dress (1-3)[9]

X_{12} FEED ability to eat (1-3)

X_{13} BATH ability to bath or shower (1-4)

X_{14} WASH ability to wash hands and face (1-3)

X_{15} TOILET ability to use a toilet or commode, day and night (1-8)

X_{16} PACARE need for pressure area care (1-5)

X_{17} WEIGHT dummy variable indicating if overweight (1-2)

X_{18} BHELP dummy variable indicating if bath/shower given on day of monitoring care (1-2)

X_{19} GETUP ability to get up (1-3)

X_{20} GOBED ability to go to bed (1-3)

X_{21} TRANSFER ability to transfer (bed to chair etc.) (1-4)

X_{22} WANDER wandering of patient (1-3)

(c) Model and Analysis

A similar analysis (of the relationship between TNTIME and the independent variables) to that performed on the private hospital data, was undertaken for the public hospital sample. Linear regression of TNTIME on all 22 independent variables resulted in a value of R^2 of 0.70. The coefficients are shown in Table 7.22.

Stepwise regression on the same data set resulted in a model with four independent variables, all with significant coefficients (see Table 7.23). The value of R^2 for this model was 0.65. As was the case for the private hospital sample, the residuals increased with increasing disability. The

TABLE 7.22

RESULTS OF ORDINARY LEAST SQUARES REGRESSION OF DIRECT NURSING TIME ON ALL EXPLANATORY VARIABLES - PUBLIC HOSPITAL DATA

Explanatory Variable	Coefficient Estimate	Standard Error	t
CONSTANT	-98.43		
AGE	0.19	0.51	0.37
SEX	6.88	16.93	0.41
WARD	-5.98	5.24	-1.14
MOBILITY	10.93	5.36	2.04 *
VISION	-5.12	6.78	-0.76
HEARING	5.43	5.66	0.96
INCONT	-11.32	9.15	-1.24
BINC	6.30	8.43	0.75
CATH	11.49	17.96	0.64
MENTAL	-4.25	4.75	-0.90
DRESS	-30.19	16.66	-1.81
FEED	25.38	7.91	3.22 **
BATH	9.64	10.86	0.89
WASH	11.66	14.22	0.82
TOILET	5.16	4.77	1.08
PACARE	3.33	4.33	0.77
WEIGHT	15.12	10.19	1.48
BHELP	5.42	8.65	0.63
GETUP	4.22	17.25	0.25
GOBED	19.70	17.74	1.11
TRANSFER	2.25	14.04	0.16
WANDER	14.10	13.09	1.08

$R^2 = 0.70$

** Significant at the 0.01 level (1 tail test)
* Significant at the 0.05 level (1 tail test)

residuals were tested for heteroscedasticity. The Goldfeld-Quandt test resulted in a value of F of 3.08 which was significant at the 0.01 level ($F(.01) = 2.78$). Therefore the assumption of homoscedastic errors was violated.

A plot of the residuals against variable TOILET indicated a relationship between the two. The model was transformed by dividing equation 7.1 by $\sqrt{\text{TOILET}}$. (This is the same transformation as was used in private hospital care). The full model was re-estimated and the residuals from this transformed model were tested for heteroscedasticity. The value of F obtained 1.08 was not significant (F(.05) = 1.99), hence the errors from the transformed model did not violate the assumption of homoscedasticity. The transformed model (using the same transformation as that used for private hospital patients) is therefore used in the following analysis of nursing care in public hospital.

TABLE 7.23

SIGNIFICANT REGRESSION COEFFICIENTS FROM STEPWISE REGRESSION - PUBLIC HOSPITAL DATA

Explanatory Variable	Coefficient Estimate b	Standard Error	t
CONSTANT	-58.96		
TOILET	8.88	3.27	2.67 **
FEED	20.57	5.93	3.47 ***
GOBED	27.49	11.54	2.38 **
MOBILITY	7.45	4.22	1.77 *

R^2 = 0.65
*** Significant at the 0.001 level (1 tail test)
** Significant at the 0.01 level (1 tail test)
* Significant at the 0.05 level (1 tail test)

Stepwise regression using weighted least squares resulted in a model with six variables all with significant coefficients (see Table 7.24). This model explained a proportion, 0.66, of the variation in the dependent variable TNTIME, somewhat less than the proportion 0.73 obtained for private hospital care. Once again variable TOILET explained singly a greater proportion of the variation in TNTIME than any other variable (0.55). The remaining variables with significant coefficients in the public hospital model differ from those obtained in the private hospital model (see Table 7.18). This may be explained in part by the greater disability of the public hospital patients so that variables such as DRESS, WASH and PACARE are no longer significant (since the majority of public hospital patients require help with these tasks - see Table 7.1). Conversely variable FEED which was not significant in the private hospital model (very few private hospital patients required to be fed)

TABLE 7.24

SIGNIFICANT COEFFICIENTS FROM WEIGHTED LEAST SQUARES REGRESSION ANALYSIS - PUBLIC HOSPITAL DATA

Explanatory Variable	Coefficient Estimate	Standard Error	t
CONSTANT	-102.97		
TOILET	7.09	2.72	2.60 **
FEED	22.38	5.90	3.80 ***
GOBED	28.81	8.35	3.45 ***
WANDER	19.08	6.96	2.74 **
MOBILITY	9.75	4.34	2.24 *
WEIGHT	14.19	8.06	1.76 *

*** Significant at the 0.001 level (1 tail test)
** Significant at the 0.01 level (1 tail test)
* Significant at the 0.05 level (1 tail test)

is significant in the public hospital model. Variable MOBILITY is also now significant and may be representing a combination of the effects of self-care disabilities.[10]

Variable MENTAL is not significant in the public hospital model. Most patients with mental incapacity in public hospital also had severe physical incapacity. The insignificance of variable MENTAL indicates that the physical incapacity was sufficient to explain the nursing care consumed. Mental incapacity did not demand a greater level of care for these patients.

10 There was no evidence of multicollinearity between mobility and the self-care variables.

In the private hospital there were a number of mobile, relatively physically able, but mentally confused patients, whose mental incapacity warranted their receiving additional nursing care, hence the significance of variable MENTAL in the private hospital model. Variable WANDER in the public hospital model is performing a similar function.

It was shown (Table 7.3) that the women in public hospital were more dependent than the men yet variable SEX is not significant. Hence the larger care times of the women patients can be explained in terms of their greater disabilities. This result confirms that obtained by Gault (1982).

Neither of the incontinence variables is significant yet each of them is by itself related to the direct nursing care consumed (see Table 7.11). Analagous to the case of the private hospital patients, the conclusion is that the hospital's policy of regular toileting of all patients produces a similar workload (in terms of nursing care[11]) for the care of both continent and incontinent patients, who require toileting help. Hence variable TOILET is sufficient to explain the care received.

The six variable model was used to predict the direct nursing care time, from the values of the explanatory variables, for each of the 117 patients in public hospital (see Figure 7.9). The model predicts quite well at the lower values of TNTIME (lower dependency) but is less able to represent the greater variation at the higher levels of dependency. This is quantified in Table 7.25 which shows the standard error of the

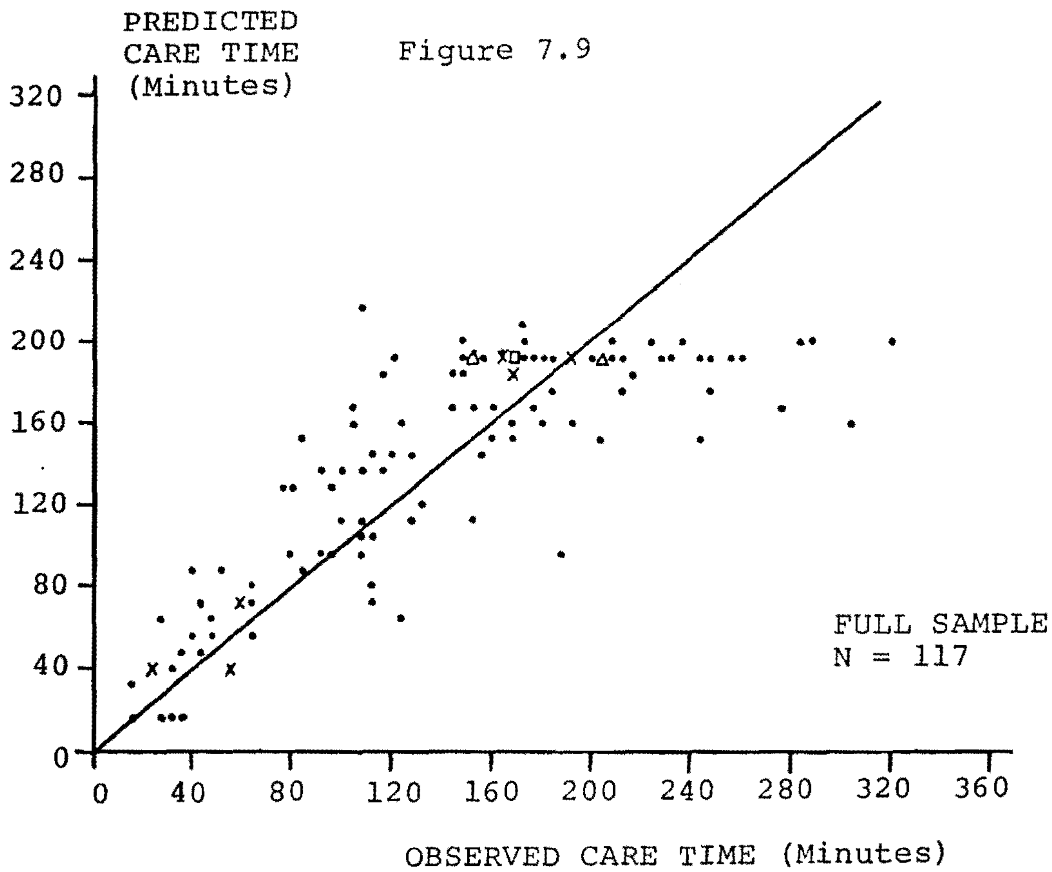
---

11 The laundry workload would of course increase.

Figures 7.9 - 7.11

DIRECT NURSING CARE IN PUBLIC HOSPITAL
PLOT OF PREDICTED AGAINST OBSERVED VALUES

Figure 7.9



● 1 observation

X 2 observations

Δ 3 observations

□ 4 observations

Figure 7.10 - PUBLIC HOSPITAL

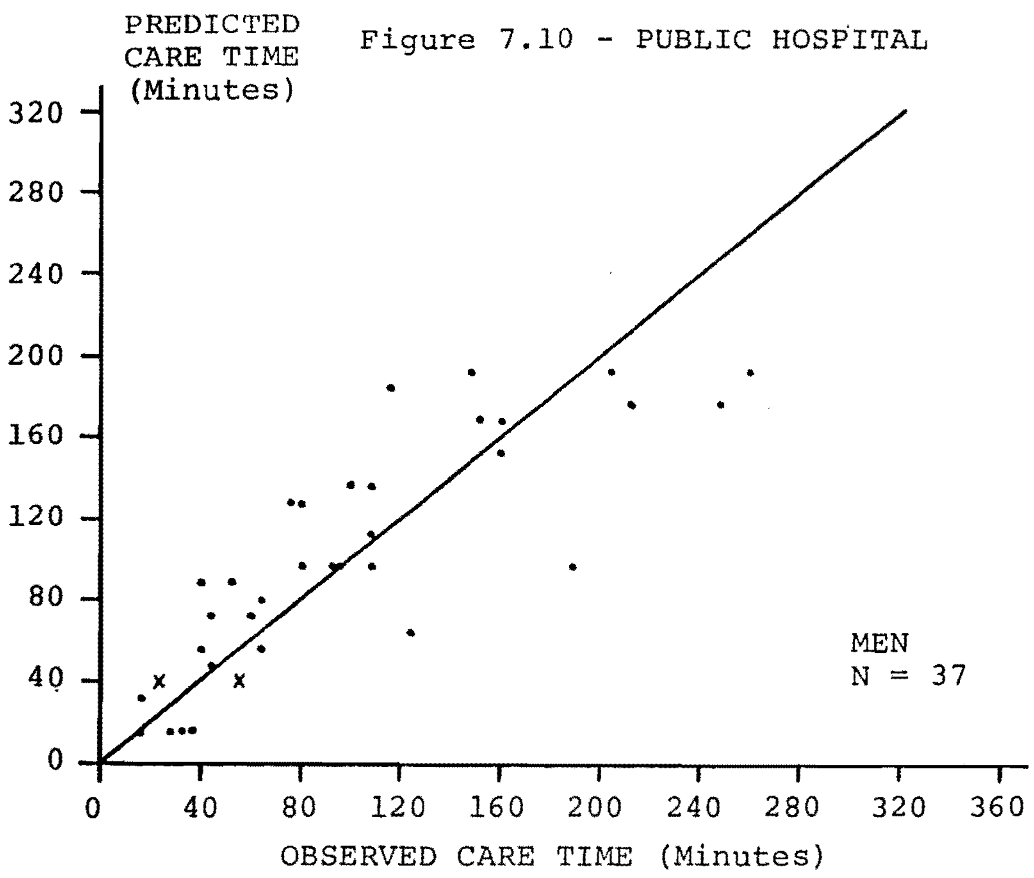


Figure 7.11 - PUBLIC HOSPITAL

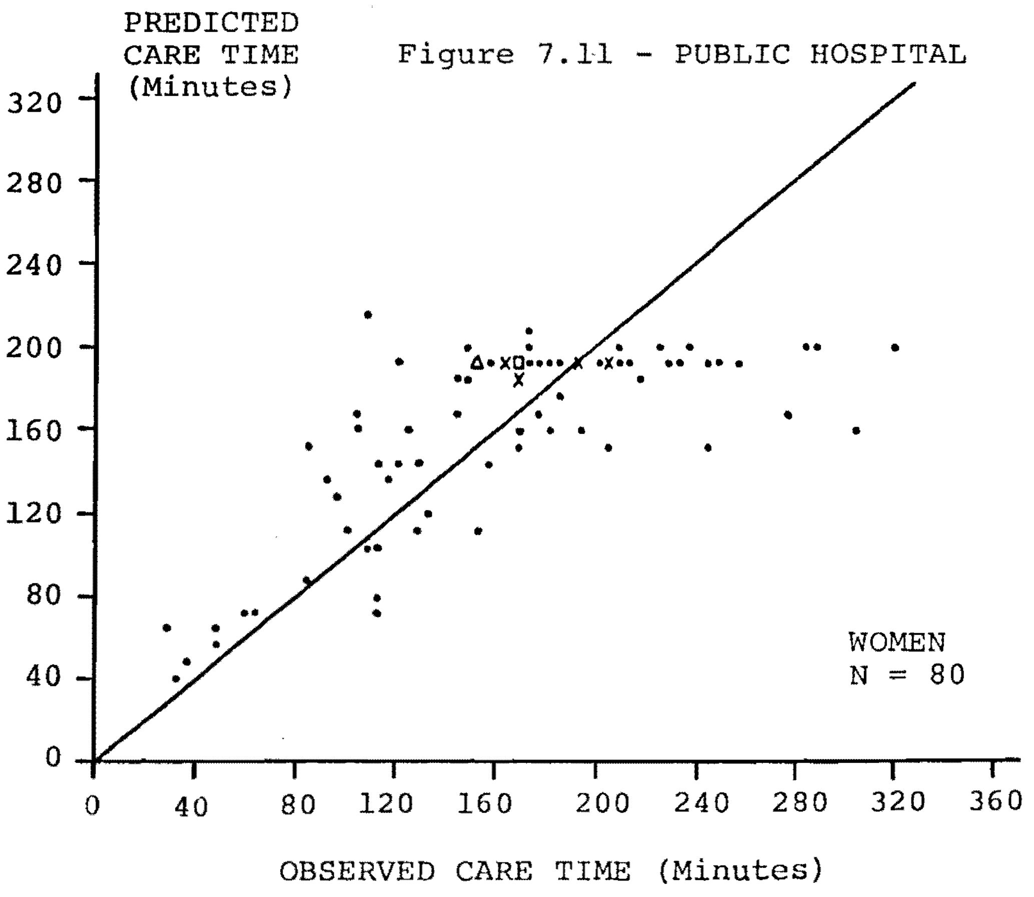


TABLE 7.25

PREDICTED CARE TIMES AT DIFFERENT LEVELS OF DEPENDENCIES - PUBLIC HOSPITAL DATA

	Dependency		
	Lowest	Mean	Highest
Predicted care time (mins)	15.17	139.80	213.27
s.d. of predictor (mins)	7.98	3.92	25.22
s.d. of prediction (mins)	25.14	42.61	53.95

predictor and prediction at the lowest, mean and highest dependency levels observed. The standard errors are similar to those resulting from the private hospital model (see Table 7.19). The standard error is larger for patients of higher dependencies reflecting the greater variation in care times of these patients.

(d) Testing for Model Stability in Subsamples

The performance of the six-variable transformed model was compared for the men and women patient subsamples. It has already been noted that the women patients were more dependent than the men (see Table 7.3). From the results of the previous section the model should perform less well for the women patients than for the men. This is illustrated in Figures 7.10 and 7.11 which show the predicted care time for each patient in the men's and women's subgroups respectively. The model explained 71 percent of the variation in TNTIME for the men but only 51 percent for the women.

The model was tested for robustness for the men and women patient subsamples. Separate estimates of the coefficients (of the six explanatory variables) were obtained for the two subgroups. The performance of these separate models was compared with the model of the combined data using the Chow test. The value of F obtained was 1.50 which was not significant ($F_{.05} = 2.09$) hence there is no significant improvement to be gained by fitting models of nursing care, separately, to the men and women subgroups.

Table 7.26 shows the standard errors when predicting at the mean dependency levels of the men and women. The predicted care times are very close to the mean observed care times (95 for men and 161 for women). The standard error of prediction

TABLE 7.26

STANDARD ERRORS OF PREDICTION AT MEAN DISABILITY LEVELS OF MEN AND WOMEN - PUBLIC HOSPITAL DATA

	Dependency	
	Mean for men	Mean for women
Predicted care time	96.78	159.66
s.d. of predictor (mins)	3.74	4.61
s.d. of prediction (mins)	35.80	45.48

of the care time of the women patients is greater than that for the men. But it should be remembered that this is for the care time of an *individual* patient. There were 35 patients on each ward so that the standard error of predicted direct care time for a whole ward of women, for one day, would be only 269 minutes (i.e. 45.48 $\sqrt{35}$) or 4.5 hours, compared to the total consumption of direct care time of over 93 nurse hours per day i.e. a percentage error of 4.8 percent.

7.6.4 Community Sample

The community sample was drawn from the short-stay patients in the private hospital so that the private hospital model relating nursing care to disabilities may also be applied to this group in order to predict the nursing care received while in hospital.

The elderly in the community sample, also received nursing care when living at home, but this may not necessarily be delivered by a professional nurse. In the home situation nursing care is provided from a variety of sources: formal help e.g. the district nurse, and 'informal' help from family and friends. There are two major difficulties in measuring the total nursing input and relating it to patient disabilities. Firstly "the community" is not a homogeneous care setting. Standards may not be equivalent and task frequencies (e.g. number of baths per week) may differ so that even patients with the same disabilities may be receiving different 'treatments'. Secondly, even if the treatments were uniform, the times taken by a professional nurse (e.g. to bath a patient) may not resemble the time taken by a lay-person so that it may not be valid to add hours of district nurse time to hours spent by informal carers. These difficulties preclude the estimation of the empirical relationship between nursing care time and disabilities, and such an estimation was not attempted. Instead the provision of total care (measured in monetary terms) was used as the dependent variable in a model which included patient disabilities as independent variables. This model is described in Chapter 10.

7.6.5 Applicability and Limitations of the Models

The models as estimated are of a descriptive nature. The dependent variable is the direct nursing care actually received by the patients in the hospitals surveyed. Predictions from the models are of the nursing care that would be received by patients of various disability levels in these hospitals. In considering the applicability of the models beyond the hospitals of the study, it is very important to distinguish between descriptive and prescriptive uses.

(a) Descriptive Uses

For a different hospital setting one could obtain data of the form used in this study and then re-estimate the model for that hospital. It is quite possible that compared with the estimated relationships found here, the variables selected as being significant may be somewhat different. It is very likely that the estimated coefficients would differ. However, once the specific form of model appropriate for the new care environment had been obtained, it could then be used by the hospital administration to predict nursing requirements for a different group of patients with their own particular disability levels.

In other words the actual coefficients obtained may be in some degree specific to the hospitals used in this study. In contrast, the approach used is of general applicability.

(b) Prescriptive Uses

The main reason why it would not be appropriate to use the models as estimated to determine how much nursing care ought to be provided in different hospital settings, is the need to distinguish between received and required care, (Rhys Hearn and Howard, 1979; Tilquin, Saulnier, Lambert, Carle, 1983).

The level of care provided in a particular institution will vary according to such factors as its income and the professional views of the institution's administrators, as well as the wealth of the country, and the expectations of the society.

With each different level of care provided, the estimated coefficients in the model would alter. The resulting changes may be of a complex nature, since as nursing becomes a scarcer resource so its relative provision for different tasks may be modified. For example there may be proportionately greater emphasis given to the care of the most dependent patients.

If the models as estimated were used as prescriptive tools to determine the provision of nursing care in other hospitals, it would imply that the particular levels of care provided in this study were seen as being the correct standard for geriatric care in general.

(This is not to say that the level of care provided in the hospitals observed, was anything other than satisfactory. In fact the standard appeared to be above that of care policies used in British studies (Rhys Hearn, 1979, 1983) in terms of the frequency of care tasks performed for patients).

A model of the type estimated here could be used as a normative planning tool. However to be used in this way it would need to be re-estimated using data from a number of geriatric institutions where the level of care provided was judged by health-care decision makers to be appropriate, that is, neither too high nor too low. The estimated model could then be used to determine nursing requirements in other settings, with varying patient disability mixes.

7.7 IMPLICATIONS OF THE RESULTS

The results of this study of direct nursing care and patient dependency have shown that patients in both public and private hospital cover a wide range of dependency. A large range was also observed in the consumption of direct nursing care by individual patients.

The study has also demonstrated a relationship between measures of patient dependency and the consumption of direct nursing care by individual patients. This has implications for the provision of nursing resources. The total nursing resources required by a ward or hospital will depend upon the disability mix of the patients being cared for.

The variability of direct nursing care time was found to increase with increasing patient dependency. For wards of very dependent patients there would be substantial variation in nursing care consumed from day to day and also from ward to ward. This result suggests that, in addition to providing adequate nursing resources to meet the *average daily workload expected* (for the particular dependency levels of the patients), hospitals caring for patients of a high average dependency should make some provision for this high variability in the consumption of nursing resources.

7.8 SUMMARY

The levels of disabilities and functional capacities of samples of patients in public and private geriatric hospitals were measured and the direct nursing care received over a 24 hour period was recorded. A wide range of levels of disabilities and care times was observed.

In public hospital, the women patients were on average significantly more dependent than the men, whereas in private hospital there was very little difference between the average levels of dependencies of the men and women.

The long-stay patients in public hospital were on average more dependent than the long-stay private hospital patients. This was on account of the high average dependency of the public hospital women patients. There was no significant difference between the dependency of the long-stay men in private and public hospital.

In private hospital care, the short-stay patients were less dependent than the long-stay patients.

The direct nursing care consumed by patients was consistent with these dependency differences. The mean direct care time in the public hospital was 140 minutes with a standard deviation of 71 minutes; the mean for the women patients being 161 minutes and for the men, 95 minutes. For the private hospitals studied, the mean direct care time for the long-stay patients was 96 minutes (standard deviation 74 minutes), and for the short-stay patients the mean was 68 minutes (standard deviation 47 minutes).

Models were developed relating direct nursing care to measures of patient dependency. A weighted least squares model with seven independent variables explained 73 percent of the variation in the measured direct nursing care time in the two private hospitals. A model of the same form, but with six independent variables explained 66 percent of the variation in direct nursing care time in the public hospital. In both models a variable measuring toileting ability was the most important determinant of nursing care and explained by itself over 50 percent of the variation in the measured amount of direct nursing care. Other significant variables in the model were measures of self-care disabilities. Of the functional capacity measures, only mobility and mental capacity had significant coefficients; the others (including measures of incontinence) did not improve significantly the explanatory power of either of the models.

The variance in direct care time was found to be greater for patients of greater dependency. When using the models to predict the care time from the disability measurements of the patients, the standard error of such predictions ranged from 18 minutes for the least dependent patient to 54 minutes for the most dependent patient.

The private hospital model can be applied to long and short-stay patients even though the long-stay are on the average more dependent.

A small but significant difference was apparent between the men's and women's private hospitals in that patients at the men's hospital received more care time after allowing for their disabilities. The remaining structure of the private hospital model i.e. the relationship between care time and disabilities remains unchanged.

The public hospital model can be applied to men and women patients. The standard error of prediction for the women patients is higher because of their greater dependency.

The immediate applicability of the models is restricted to the hospitals studied. The general methodology used, however, has wider application. Such use could be for either descriptive or prescriptive purposes. In each case the model would require re-estimation using data collected in the particular care setting.

This study has established a strong relationship between the consumption of direct nursing care (by individual patients) and measures of patient dependency. A large variation has been observed in nursing care times for each hospital studied. This therefore demonstrates the importance of measuring patient dependency when planning nursing resources for care of the dependent elderly. In the following two chapters (8 and 9) dependency-linked cost estimates, based on the consumption of direct nursing care, are derived for both public and private hospital care.

CHAPTER 8

THE COST OF PUBLIC HOSPITAL LONG--STAY CARE

CONTENTS PAGE

8.1	INTRODUCTION	166
8.2	HOSPITAL SAMPLED	166
	8.2.1 Patient Dependency	168
	8.2.2 Operating Costs	169
	8.2.3 Level of Care	171
8.3	INPUTS TO PUBLIC HOSPITAL CARE	173
8.4	HOTEL CARE	173
	8.4.1 Capital Costs of Accommodation	173
	8.4.2 Hotel Services	178
	(a) 'On-Site' Hotel Services	178
	(b) Hotel Services Provided Centrally	183
	(c) Total Cost of Hotel Services	200
8.5	NURSING CARE	202
	8.5.1 Provision of the nursing resource	202
	8.5.2 Estimation of the average cost of nursing care	204
	8.5.3 Estimation of the cost of direct care	206
	8.5.4 Estimation of the cost of indirect care	208
	8.5.5 Estimation of the total cost of nursing care	214
	8.5.6 Selecting a method of estimation	217
	8.5.7 Orderly - nursing costs	221
8.6	MEDICAL CARE	222
	8.6.1 Doctor time	222
	8.6.2 Pharmaceuticals and Dressings	224
8.7	OTHER HEALTH PROFESSIONAL CARE	225
8.8	THE TOTAL COST OF LONG-STAY CARE RELATED TO DEPENDENCY	227
	APPENDIX - Nurse Staffing Leverls in Men's and Women's Wards in Public Hospital	235

CHAPTER 8

THE COST OF PUBLIC HOSPITAL LONG-STAY CARE

8.1 INTRODUCTION

In this chapter the various inputs to public hospital care of the elderly are identified. The unit costs of providing these resources are estimated, using cost information for the financial year 1983/84. Each resource is considered in turn to determine how its usage varies between patients, in particular whether consumption is equal for each patient or if it varies by the level of dependency. The cost of each resource to the individual patient is estimated and these estimates are combined to yield estimates of the total cost of long-stay public hospital care for elderly patients of different dependencies.

8.2 HOSPITAL SAMPLED

The data on patients and costs used in this chapter were collected from Coronation, the main long-stay geriatric hospital in Christchurch. A total of 382 long-stay public hospital beds are provided in North Canterbury by the Canterbury Hospital Board (CHB, formerly the North Canterbury Hospital Board, NCHB). Of these, 133 are for psychogeriatric patients and 22 are designated 'young disabled'.

The remaining 227 beds are occupied by adult long-stay patients. 202 of these are designated 'geriatric' but some patients in the 25 other beds for adult long-stay might be over 65 years of age, so that the total number of elderly patients would vary between 202 and 227. The hospitals offering these beds are shown in table 8.1. [A further 71 elderly patients, on the waiting list for long-term care, occupied beds in acute hospitals in the area.]

TABLE 8.1

LONG-STAY PUBLIC HOSPITAL BEDS USED BY GERIATRIC PATIENTS* IN THE CANTERBURY HOSPITAL BOARD AREA 1983/84

Hospital	Geriatric beds	Other adult long-stay beds	Total
Coronation	117	-	117
Jubilee	46	-	46
Burwood (Ward 10)	30	(Ward 2) 23	53
Oxford	9	2	11
Total	202	25	227

*Source: Statistics Officer, Canterbury Hospital Board.

The hospital sampled, Coronation, designates 117 of its 141 beds for geriatric care. 16 beds were available for respiratory patients, some of whom were over 65 years of age and 8 beds were for radiotherapy patients who were receiving treatment at another hospital.

Information on the 117 geriatric patients, will be used to estimate the costs of public hospital long-stay care for the elderly in Christchurch. The cost estimates to be derived do not apply to psychogeriatric patients for whom the costs of care are much higher, nor to the elderly patients on the waiting list for long-term care who are currently occupying beds in acute hospitals.

In the next section consideration is given to how representative Coronation is of the other long-stay public hospitals in the area. This is discussed with respect to level of patient dependency, average operating costs and the level of care.

8.2.1 Patient Dependency

Patients applying for long-stay public hospital care are assessed by a group of health professionals including a social worker and a geriatrician, at the Canterbury Hospital Board's Geriatric Assessment and Rehabilitation Unit. If long-term care is judged to be appropriate then patients are placed on a waiting list. Individual preferences on choice of hospital are taken into account but the average level of dependency in the various hospitals can be expected to be similar.

The results of a survey of the level of dependency of elderly (aged over 65 years) in institutional care in North Canterbury by Fox (1983) are shown in table 8.2.

TABLE 8.2

PERCENTAGE DISTRIBUTION OF LEVEL OF DEPENDENCY OF PATIENTS (OVER 65 YEARS) IN PUBLIC HOSPITAL LONG-STAY GERIATRIC BEDS IN CHRISTCHURCH, 1983

Public Hospital	Assessed Dependency Level		
	Independent	Partially dependent	Dependent
Coronation	0.0	0.0	100.0
Jubilee	0.0	2.2	97.8
Burwood (Ward 10)	0.0	6.9	91.3
Oxford	0.0	33.3	66.7
All patients over 65 in North Canterbury*	0.0	5.3	94.7

*Source: Fox, K. "The elderly in Special Accommodation".

It appears that Coronation has more patients in the dependent category than would be expected from the average for the area. However this average includes one country hospital (Oxford) where probably on account of the greater difficulty of home services there is a greater proportion of partially dependent patients. Any apparent differences between the hospitals' patients must also be judged in the light of the author's own comments about the survey:

> "... both the measure itself and the procedures used may have been insufficiently sensitive, and too subjective".

The survey was designed to identify variations between the patients cared for in different types of accommodation: rest and residential homes, public and private hospitals and is a blunt instrument to compare differences within a category of care.

Nevertheless, the hospital sampled drew its patients from a large city where home nursing, home aid and other community services were available and therefore whilst the level of dependency of the patients might be regarded as typical of city hospitals, caution should be exercised when applying results to country hospitals.

8.2.2 Operating Costs

Information on operating costs is contained in each hospital's Institutional Maintenance Report published each year by the Canterbury Hospital Board. These reports list costs which it is possible to associate with an individual hospital, especially the costs of services provided on site (e.g., salaries, energy and cleaning costs). They exclude the cost of those services which are supplied centrally by the Canterbury Hospital Board to its many hospitals, e.g., laundry, maintenance, central administration. [The accounting system did not identify the portions of the cost of these central services which were attributable to a particular hospital]. The Institutional Maintenance Reports (in the Annual Report, NCHB) for each geriatric hospital were examined for the year 1983/84. The operating costs associated with each hospital, termed 'partial' operating costs are shown in table 8.3. The average weekly (partial) cost per patient was estimated from $\frac{\text{annual cost}}{\text{average occupied beds x 52}}$.

TABLE 8.3

PARTIAL* OPERATING COSTS FOR GERIATRIC
HOSPITALS IN NORTH CANTERBURY, 1983/84

Geriatric Hospital	Partial Annual Operating Costs ($)	Average occupied beds	Average Weekly (partial) cost per patient ($)
Coronation	2,503,332	128.6	374
Jubilee	848,971**	45.5	359
Oxford	269,756***	14.3***	363

* excluding the cost of central services of the CHB.

** this is an estimate of the cost of the 46 hospital beds i.e., net of the cost of the 32 residential home beds on the same site. The cost of the home beds was estimated by equating the cost per occupied bed to that of Lyndhurst, a 22 bed Public Residential Home.

*** These figures refer to the total hospital i.e., 4 medical and 11 long-stay beds.

[Burwood Hospital is not shown in the table since it was not possible to separate the cost of the geriatric wards from total expenditure].

The similarity of these (partial) cost estimates does not guarantee that the whole daily operating costs behave in the same way. However (as will be shown later in chapter) the costs included in the Institutional Maintenance Reports form the bulk of the total costs, and their similarity for the hospitals considered, supports the view that 'on site' services are comparable. Differences in 'off-site' services (provided centrally) might well be due to differences in the size and type of buildings (e.g., maintenance costs) or dependency of patients (e.g., laundry cost). These points will be considered later in the chapter.

8.2.3 Level of Care

An analysis of hospital costs must take into account the level of care offered. Hospitals may differ with respect to the type of care given and those offering a higher standard of care would in general have higher costs. In chapter 3 measures of the level of care were considered. Some of these are measures of the inputs to care e.g., number of staff employed, some relate to the deployment of the resources.

One important determinant of the level of care of the elderly is the level of nursing care. It is possible to measure this to some extent by noting the frequency with which various care tasks e.g., bathing, turning, toileting, are undertaken. This data was collected for Coronation, the hospital sampled,and when comparing the task frequencies there with those of hospitals cited in overseas studies [Rhys Hearn, 1979, 1983] the result is that the standard of care is at least as high as that provided in other countries. This is reported in detail in chapter 11. However for the purposes of this chapter it is assumed that the level of care offered in the hospital sampled was acceptable.

Information on the frequency of care tasks was not collected for the other geriatric hospitals in the area, so that direct comparisons of the level of care cannot be made. Instead comparisons are based on the levels of various inputs to care. Variations in these would be reflected in the operating costs of care so that the extent to which the costs shown in table 8.3 are similar, indicates that the inputs to care are comparable. Three inputs which might reflect differences in care levels are nursing, physiotherapy and occupational therapy. The numbers of staff in each of these areas relative to the number of patients in the hospitals is shown in table 8.4. There is very little difference in these inputs and since they can be considered to be indicators of the level of care, it is concluded that care at Coronation is representative of public hospital long-stay care in the area.

TABLE 8.4

STAFF TO PATIENT RATIOS IN LONG-STAY HOSPITALS IN NORTH CANTERBURY 1983/84

	Number of staff per patient		
Hospital	Nursing	Physiotherapy	Occupational Therapy
Coronation	0.749	0.001	0.015
Jubilee	0.751	0.014	0.017
Oxford	0.713	-	-

8.3 INPUTS TO PUBLIC HOSPITAL CARE

In chapter 4 the resources required for care of the elderly in institutions were outlined. In the following sections these resources are discussed in relation to public hospital care. The inputs to public hospital care are organized into groups according to the aspect of care to which they contribute. These groups are Hotel Care, Nursing Care, Medical Care, Health Professional Care.

8.4 HOTEL CARE

This includes the provision of accommodation and the associated hotel services. Since the former is funded from capital expenditure budget and the latter from annual operating costs budgets they will be dealt with separately.

8.4.1 Capital Costs of Accommodation

Under this heading is included the provision of land, buildings, equipment and furniture. Since there was no special provision or additional facilities provided for any particular type of patient it will be assumed that each of the 141 patients in the hospital has an equal share of the accommodation resources regardless of disability.

In order to estimate the capital costs of long-stay care, a valuation of the hospital's land, building and equipment must be obtained. The hospital sampled was very old, mainly in three storeys and had very extensive grounds. Long-stay hospitals of the future will be in one storey buildings with smaller gardens. Two valuations were therefore obtained: the current value i.e., of the existing accommodation, and the replacement value i.e., for the construction of a new hospital. The merits of using each of these to estimate the capital costs of long-stay care will be considered later in the chapter.

(a) Land

The most recent (1980) Government valuation of the land was $45,700. The hospital site was large (2.3 hectares) though not well developed. It was in a residential zone where sections of about 800 square metres sold for approximately $50,000. The market value of the land was estimated to be around $750,000[1] or $5,319 per bed.

The area of land per bed came to 163 square metres. It is unlikely that long-stay hospitals built in the future will occupy such large sites. Current policy is to attach long-stay wings to existing acute hospitals. A 60 bed wing to be built in Christchurch, which is currently at the planning stage, allows approximately 46 square metres per bed. However the unit cost of space is higher since the site is fully developed. The cost per bed of the land is estimated at $2,874. It should be noted that this does not include land occupied by services shared with the main hospital e.g., kitchens, boilerhouse, car parking etc., and therefore represents the marginal cost per bed.

---

[1] This estimate was provided by the CHB Planning Officer. It is based on the site yielding 15 sections after allowing for some 'loss' of land for access roads.

(b) Buildings

The (1980) Government valuation for the hospital buildings was only $115,000. The hospital was old (1913) and in poor condition. The current market value was estimated at around $160,000 or $1,135 per bed. Using this figure to estimate the cost of long-stay care would be to assume that there was an available supply of old, suitable buildings. This is not the case.

Proposed long-stay wings to be built shortly, average $50,000 per bed. This is for a single storey construction. This cost includes accommodation for therapists and treatment, but excludes kitchen, laundry and boilerhouse accommodation (these facilities are available and shared by other parts of the hospital complex).

(c) Equipment

There was no valuation available of the equipment, furnishings etc., contained in the hospital. The Hospital Design and Evaluation Unit estimated these costs to be between 10 and 20% of the cost of the building, for new hospitals. The replacement valuations of equipment, obtained for insurance purposes for private hospitals was 17 or 18% of the replacement valuation of the buildings. Using a proportion of 17.5% of buildings value yields an estimate of the cost of new equipment of $8,750 per bed. The value of existing equipment was estimated at half this sum (i.e., $4,375), since for private hospitals the indemnity valuation of equipment was about half the replacement value.

CHOICE OF CAPITAL VALUE

Table 8.5 summarizes the capital cost components for the accommodation resources which are currently provided and also for their replacement. Valuation using the current provision would be a justified basis for estimation of long-term care of the elderly only if this type of provision was typical or was to be the norm for the future. Neither of these are true. The amount of land occupied by the hospital site is excessively large; the hospital itself is very old and is becoming uneconomic to maintain. In the future planning of care for the elderly, accommodation such as that currently provided will not be a viable alternative. Therefore the replacement value will be used to estimate the level of capital investment required for the future provision of long-stay care. However when comparing private and public hospital care, or institutional and community care the market value will be of use in that it represents the current situation.

TABLE 8.5

CAPITAL VALUE OF ACCOMMODATION RESOURCES
PER LONG-STAY BED, 1983/84

	Market value (current provision)	Replacement value (future provision)
Area per bed (m^2)	163	46
Value of land ($)	5,319	2,874
Value of buildings ($)	1,135	50,000
Value of equipment ($)	4,375	8,750
Total capital value ($)	10,829	61,624

ANNUAL COST OF CAPITAL

An annual cost of capital can be obtained by amortizing the capital value of an asset over its life (Rees, 1973). The result, the annual equivalent, can be considered as an imputed rental value. The assumption is that after the expiry of the agreed life period, the asset is worthless. Land has an infinite life and the computations are equivalent to the interest lost in having the capital tied up for a year. The results depend upon the interest rate chosen. Health services projects are evaluated using a 10% interest rate. Table 8.6 shows the results of using 5% and 10% for both the market and replacement values of table 8.5. The costs are shown per bed per week. Since the occupancy rates for geriatric long-stay care are very high (98.7% for the hospital studied) these figures can be used to estimate the cost per patient.

TABLE 8.6

COST PER BED PER WEEK OF CAPITAL COSTS OF ACCOMMODATION (BASED ON ANNUAL EQUIVALENTS OF CAPITAL VALUATIONS) 1983/84

Interest rate		.05		.10	
Valuation		market	replacement	market	replacement
land(1)	($)	5.11	2.76	10.23	5.52
buildings(2)	($)	1.15	50.80	2.19	96.47
equipment(3)	($)	10.90	16.21	13.69	22.12
total accommodation cost		17.16	69.77	26.11	124.11

(1) land is valued at perpetuity

(2) the life of buildings is taken to be 60 years

(3) the life of new equipment is taken to be 15 years, existing equipment at 10 years.

8.4.2 Hotel Services

This section considers those services necessary for 'hotel' care. They are heating, lighting, administration, cleaning, maintenance, laundry and food. Some hotel services were provided 'on site' from resources assigned specifically to the hospital. Annual expenditure on these services was shown in the hospital's accounts. Other services were provided centrally by the Canterbury Hospital Board. Cost information was available only on total expenditure (for each service) to all hospitals served. The share of costs to an individual hospital was not recorded. For this reason the two sorts of provision are dealt with separately.

(a) 'On-site' hotel services

These are heating and other energy, (part of) administration, telephone, rates, postage and stationery, catering and personal laundry.

These services were used by all patients in the 141 beds (117 geriatric, 16 respiratory, 8 radiotherapy). It was not possible to separate the costs of the geriatric patients from the total cost of each service.

Aggregate information on hospital expenditure was taken from Coronation Hospital's 1983/84 Institutional Maintenance Report contained in the Canterbury Hospital Board's Annual Report (1984). This was supplemented by more detailed information obtained from the accounting office of the CHB. Expenditure on on-site hotel services is shown in table 8.7.

TABLE 8.7

CORONATION HOSPITAL ANNUAL EXPENDITURE 1983/84
FOR 'ON SITE' HOTEL SERVICES

On-site Service	Expenditure ($)
1. food and catering	279,795
2. energy	118,041
3. administration*	51,699
4. cleaning (1) outside contract	126,400
(11) orderlies**	53,019
5. orderlies** - goods movements	83,544
6. telephone, rates, postage, stationery	57,211
7. personal laundry	7,550

* Although Coronation Hospital has its own clerical staff, they were supervised by the house manager of a nearby acute hospital. The amount $51,699 includes 20% of this house manager's salary, to cover the cost of the estimated portion of time spent working for Coronation.

**. Duties of the orderlies included heavy cleaning which occupied approximately 33% of their time; movement of food, linen, other supplies and equipment to and from the wards, (52%) and wheeling patients to and from therapies and other treatment (15%). The amounts shown here, $53,019 and $83,544 are 33% and 52% respectively of the orderlies' salary bill. The balance ($24,099) is dealt with in the section on nursing care.

The annual cost of each of these services would increase if the number of patients increased. Therefore the occupancy rate must be taken into account when estimating an average cost per patient. The occupancy rates for each type of patient are shown in table 8.8.

TABLE 8.8

CORONATION HOSPITAL OCCUPANCY RATES 1983/84

Bed Designation	Number of beds	Occupancy Rate	Average occupied Beds
Geriatric	117	98.7	115.5
Respiratory	16	69.5	11.1
Radiotheraphy	8	24.3	1.9
Total beds	141	91.2	128.6

The weekly per patient cost for each service was estimated by weighting by the average occupied beds (AOB)

$$\text{Cost estimate} = \frac{\text{annual expenditure}}{52 \times \text{AOB}}$$

These estimates are shown in table 8.9. The value of AOB used was 128.6 except in the case of personal laundry. This service was available only to the geriatric and respiratory patients, therefore the value used was 126.6.

TABLE 8.9

ESTIMATES OF WEEKLY COST PER PATIENT OF ON-SITE* HOTEL SERVICES 1983/84

Service	Cost per patient per week ($)
food and catering*	41.84
energy	17.65
administration	7.73
cleaning (1) outside contract	18.90
(11) orderlies	7.93
orderlies - goods movements	12.49
telephone, rates, postage, stationery	8.55
personal laundry	1.15
all on-site hotel services	116.24

* The 1983/84 cost of food and catering represents the situation when Coronation supplied meals from its own kitchens. In 1984, the system was changed and Coronation was served from a nearby hospital. This does not affect the assumption of constant cost per patient but the cost amount may have changed.

This method of estimation assumes that each patient for whom the service is provided has equal use of that service. The validity of this assumption is now considered for each service.

(1) Food and catering

The same meals were provided for all 141 patients apart from the occasional geriatric patient who had a special diet (e.g. high protein). Some geriatric patients had their food pureed. In the first case the food cost might vary slightly but the preparation costs would be similar; in the second the reverse would hold. In each case the effect on cost would be small.

(2) Energy

This includes heating and lighting. The different sections of the hospital were heated to similar levels. There were no special energy requirements for particular groups of patients, therefore equal sharing of energy costs is a valid procedure for estimation.

(3) Administration

Although some administrative tasks were performed for all patients, e.g., payroll, budget work, there were others which were specific to only the long-stay geriatric patients. For example a deposit account was kept for each long-stay patient. On the other hand admission and discharge procedures were enacted more frequently for the short-stay patients (up to 16 respiratory and 8 radiotherapy). Even though the administrative costs for the geriatric patients might differ from the average cost it is not possible to say whether they are higher or lower. In the absence of such information the average cost is used as the best estimate.

(4) Cleaning

Cleaning services were from two sources. An outside agency was responsible for the cleaning of the whole building on a day to day basis. The tasks to be performed were precisely specified. Other tasks, for example, high cleaning and windows, refuse disposal and outside cleaning were undertaken by the orderlies. There was no indication that one type of patient generated more demand for these services than any other, therefore it is assumed that cleaning costs were equally shared.

(5) Orderlies - goods movements

The orderlies were responsible for the movements of supplies and equipment to and from the wards. The main tasks were: the delivery of meals from, and the return of dirty crockery to the kitchens; delivery of clean linen and collection of soiled linen. Three of the wards were located in one building and the costs of this service for these patients would be similar. However the other ward was in a separate building (annex) 1½ kilometers away hence the costs of movements would be higher. The average cost of goods movements $12.49 may therefore be slightly inflated. Reworking the calculation just for services to the main hospital yielded a very similar estimate ($12.19). The original estimate $12.49 is therefore retained.

(6) Telephone/rates/postage/stationery

The share of the rates bill is the same for each patient.

The other costs might be termed communication costs. These might be expected to be higher for the short-stay patients on account of the higher admission rate. However there was substantial contact with relatives of long-stay patients therefore any cost differences between patients is narrowed.

The average cost per patient is used as the best estimate of the cost for the geriatric patients.

(7) Personal laundry

This service was available only to the long-stay and respiratory patients. The cost would vary between patients since in some cases relatives handled this laundry. No information on this was collected, therefore the average patient cost is used as an estimate. Since this is a small component of cost the effect of departures from this assumption would not be serious.

(b) Hotel Services Provided Centrally

The Canterbury Hospital Board organizes some services centrally. These are laundry, gardening, works maintenance, engineering, central administration, supplies and transport.

The annual accounts of the CHB contain the total costs for all hospitals and clinics in the area. These are shown in table 8.10.

TABLE 8.10

CHB ANNUAL EXPENDITURE ON CENTRAL SERVICES 1983/84

Service	Expenditure 1983/84 ($)
laundry	3,378,057
gardening	411,648
works maintenance	1,895,443
engineering	3,010,344
central administration	2,240,106
supply	460,919
transport	753,970

This expenditure accounted for all city and country hospitals in the CHB area (offering between them 3,176.5 beds) and several community centres and clinics.

In order to estimate the share of cost falling on Coronation Hospital one of two methods was employed. Where possible costs incurred due to Coronation were identified from the CHB accounting office. In other cases estimates of the hospital's portion of costs were based on some 'size' indicator of the hospitals. Three types of size indicators were considered. A summary of the effects of using them is shown in table 8.11.

TABLE 8.11

METHODS OF ESTIMATING SHARE OF CHB CENTRAL SERVICES COSTS TO CORONATION HOSPITAL - FRACTION OF COST ESTIMATORS BASED ON HOSPITAL SIZE INDICATORS

Size Indicator	Coronation Hospital n	All CHB Hospitals clinics* etc. N	Cost fraction Coronation / All CHB $\frac{n}{N} \times 100$
A (i) Number of beds	141	3,176.5	4.439
A(ii) (AOB) Average number of occupied beds	128.6	2,616.3	4.915
B Number of Personnel Employed (F.T.E.)	125.3	5,476.3	2.288
C (i) Beds + Employees A(i) + B	266.3	8,652.8	3.078
C(ii) AOB + Employees A(ii) + B	253.9	8.092.6	3.137

* methods A(i) and A(ii) allocate all costs to the hospitals and do not apportion a share to the Board's clinics (which have no beds). Methods C(i) and C(ii) apportion costs to the clinics, only in proportion to the number of employees. It might seem that these methods could lead to overestimation of the share of costs to the hospitals. However it was ascertained that the usage of central services by the clinics was small relative to the hospitals and that representation by number of employees was sufficient in the estimation procedure.

Cost fractions based on these size indicators have different sets of advantages and shortcomings when used to estimate the costs of services received by an individual hospital. Their properties are now briefly discussed.

A(i). Number of beds

The simplest way to apportion central service costs is according to the number of beds. However this does not take account of variations in costs arising from variations in occupancy level (e.g. laundry). Nor does it allow for extra costs due to the higher staffing ratios at some hospitals (e.g. for acute care).

A(ii). Average number of occupied beds

This overcomes the problem of costs being related to occupancy level but it assumes that all patients would use the same amount of a service. It is suitable for patient generated demands e.g., laundry and supplies.

B. Number of Personnel Employed

This is appropriate for services whose demands are related to the number of staff rather than the number of patients. It assumes either that all staff have equal use of a service or that the average uses per staff member for each hospital are similar.

C(i). Beds and Employees

This overcomes the problem of A(ii) of differing staff/ patient ratios. It is a useful indicator for costs which are related to the physical size of a building (e.g., maintenance).

C(ii). AOB + Employees

This indicator is appropriate for costs which depend on the size and use of a building (e.g., engineering maintenance).

ESTIMATING A HOSPITAL'S SHARE OF CENTRAL SERVICE COST

Each of the Central Services listed in 8.4.2(b) is now considered and methods for estimating them are selected.

(1) Laundry

The Central Laundry Service is responsible for the supply and laundering of sheets, towels, uniforms and other items used in the hospitals.

The total weight of laundry processed in 1983/84 was 4,241,557 kilograms at a cost of $3,378,057. The cost per kilogram processed is therefore $0.79642. This does not include the cost of collection or delivery, which is debited to the Transport Department account. Nor does it include electricity costs. These are included in the costs of the hospital sharing the laundry site.

The 1983/84 costs might be unduly high because during that year the laundry moved to a new site incurring relocation costs. Moreover a large restocking of sheets and other items took place.

In order to obtain an estimate of cost which was more representative of a 'typical' year, the year's expenses were examined for 'one-off' costs associated with the change. As a result the total cost was adjusted by subtracting a relocation allowance of $19,500 and by substituting the 1984/85 cost of restocking of sheets, towels etc. ($643,054) for the 1983/84 restocking cost ($875,519). This 1984/85 restocking cost was still high but was retained to compensate for the rather low repair costs ($49,617) of the new laundry. In the future the stock costs may decrease, but the repair costs could be expected to increase.

The laundry expenditure was scanned also to identify items which did not relate to Coronation Hospital. Costs of two such items were found: an amount $66,600 for patients' clothing, $4,246 for special clothing and $2,054 for theatre dressings. However no information was available on the weight of such items laundered each year. Hence these costs are retained. The implicit assumption is that the cost per kilogram of laundering and supplying these items is similar to that of other items.

The adjusted annual expenditure of the Central Laundry Service was therefore

$$\$3,378,057 - \$19,500 - \$875,519 + \$643,054$$
$$= \$3,126,092$$

The adjusted cost per kilogram $= \dfrac{\$3,126,092}{4,241,557} = \$0.737$

This estimate of cost per kilogram to supply and launder is increased to $0.75 to allow an amount ($55,075) for electricity costs. [The laundry shared a site with a hospital and separate power costs were not available].

A further cost not shown in the laundry accounts was transportation provided by the CHB Transport Department. It was not possible to identify transport costs for the collection and delivery of laundry. (No information was available on mileage undertaken). Instead, information on transportation costs was obtained from the Public Service Garage, an organization operating on similar lines. The cost per hour of a 5 ton truck with driver was $23.40. Running costs were 73 cents per kilometer including fuel.

Coronation had six collections and six deliveries each week and was six kilometers from the laundry. This requires total weekly travel of 144 kilometers costing $105.12. Allowing 40 minutes per round trip the weekly truck and driver cost is $187.2. The cost of separate runs serving only Coronation Hospital would therefore be $292.32 per week. In practice however, Coronation is on a delivery route with at least one other hospital. Similar calculations based on a round trip of 15 kilometers and a trip time of 55 minutes yields a weekly cost of ($131.4 + $25.74) = $388.8. Allocating costs equally between the two hospitals gives the cost to Coronation of $194.4 per week.

The weekly amount of laundry generated by Coronation Hospital was estimated from a four week sample of the weight of clean linen supplies. The average weight received per week was 4,200 kilograms. Applying this to the estimated transport costs yields a cost per kilogram of 4.6 cents for transport. The unit cost of laundry is therefore estimated at (75 + 4.6) = 79.6 cents[2] per kilogram.

An estimate of the annual cost of laundry for Coronation Hospital, based on 79.6 cents per kilogram, would be $174,720 or $26.13 per occupied bed per week.

---

[2] As a check on the order of magnitude of this figure, the charges of a commercial laundry were obtained. The charge to supply and launder, including collection and delivery averaged 85 cents per kilogram. Since commercial laundries expect to make a profit the two figures are consistent.

An alternative method of estimating the Hospital's share of the Central Laundry Cost is on an occupied bed basis (method A(ii) table 8.11). Coronation has 4.915% of occupied beds in North Canterbury. Its share of annual cost would be $156,354, a weekly cost of $23.38 per occupied bed (and $24.66 when transport costs are included). This is slightly lower than the $26.13 just derived. But laundry services personnel considered that on account of the larger number of sheet changes necessary for geriatric patients, the higher estimate was more applicable.

The estimate of average weekly cost, $26.13 per occupied bed, could be used to estimate the cost for each geriatric patient. However this average includes the radiotherapy and respiratory patients whose laundry usage could well be lower than that of the geriatric patients. Moreover it was known that the average level of dependency of patients in the geriatric wards differed and it can be argued that laundry would increase with increasing disability, particularly with respect to incontinence. In order to explore these hypotheses, laundry delivery dockets were analysed to determine the weight of supplies to each ward. The results are shown in table 8.12.

There is a marked difference between the usages of linen for each ward, and consequently in the cost for the type of patient accommodated. Clearly in estimating the cost for the geriatric patients, the radiotherapy patients should be removed. This gives an average cost of $26.42 for the three geriatric wards and the annex. Removing in addition the annex patients (who comprised 12 geriatric and

TABLE 8.12

CORONATION HOSPITAL - MEAN WEIGHT OF CLEAN LINEN SUPPLIED EACH WEEK TO THE WARDS

Ward	Number of beds	Mean weekly linen for ward (Kg)	Average occupied beds AOB	Mean weekly per AOB (Kg)	Estimated* weekly cost per AOB ($)
1. Ground (Women geriatric)	35	1142.6	34.5	33.08	27.90
2. Middle (Men geriatric)	35	855.4	34.5	24.76	21.24
3. Top (Women geriatric)	35	1260.2	34.5	36.48	30.62
4. Annex (Women geriatric**)	28	695.9	23.0	30.30	25.68
5. Radio-therapy	8	15.2	1.90	8.00	7.83
Kitchen/ uniforms	-	230.7	-	1.79	-
Total	141	4200.0	128.6	32.66	26.13

* This includes a share of kitchen/uniforms cost.
** Up to 16 respiratory patients of either sex were also in the annex.

16 respiratory patients resulted in an average cost for the three wholly geriatric wards of $26.50 per occupied bed per week.

When comparing between the geriatric wards, it can be seen that the linen usage on the men's ward was only two-thirds of that of the women's. Since the linen policy was the same throughout the hospital this difference is due either to the lower prevalence of incontinence in the male patient or its more successful management (i.e., by the use of uridomes). Table 8.13 gives some information on these factors.

Although the levels of both types of incontinence were lower for the men's ward they were not significantly so. However the use of catheters or uridomes was significantly higher and the effect is even more pronounced when it is realised that this higher use was for a *smaller number* of patients suffering incontinence. For the male

TABLE 8.13

CORONATION HOSPITAL - MEAN INCONTINENCE LEVELS AND MEAN WEEKLY LINEN SUPPLIES FOR GERIATRIC PATIENTS BY WARD

Ward	Mean weekly* linen supplied per AOB (Kg)	Mean level of incontinence		Mean CATH** measure	$\bar{t}_1$ mean direct nursing time (hours in 24 hrs)
		bowel	urinary		
1. Women	34.87	1.91	2.37	1.06	2.81
2. Men	26.55	1.86	2.17	1.34	1.52
3. Women	38.27	2.29	2.40	1.06	2.66
4. Women	32.10**	2.50	2.67	1.00	2.33
Total	33.24	2.07	2.35	1.14	2.33

* This includes a share of kitchen/uniforms linen.

** CATH = 2 if catheter or uridome used, otherwise CATH = 1

*** The mean linen use of the geriatric patients in the annex is assumed not to differ from that of all annex patients.

patients then, less incontinence was present and when it did occur it could be more successfully managed. Therefore rather than using the average linen cost of $26.60, a better estimate for the individual patient would take into account incontinence and its management. The effects of these two factors are reflected in the direct care time received ($\bar{t}_1$, table 8.13). The linen use can be inferred from the direct care time. A regression of linen use and mean care time resulted in the following equation:

$$\text{LINEN} = 14.50 + 7.92\,\bar{t}_1$$

$$(r^2 = 0.84)$$

where LINEN is the mean linen supplied per average occupied bed. The cost of linen for a particular patient (80 cents per kilogram) would be estimated by \$11.60 + \$6.34 t_1.

(2) Gardening

For this service it was possible to identify and cost out resources associated with Coronation Hospital. A number of grounds staff were assigned to Coronation. Their total salaries were $69,105 for the year 1983/84.

Expenditure on materials for the whole CHB gardening service formed 5.743% of total gardening expenditure. If it is assumed that this percentage applies to the material costs (as a fraction of total gardening costs) at Coronation Hospital, then gardening expenditure for Coronation would be $73,315 (allowing $4,210 for materials).

Coronation earned revenues from the sale of garden produce. The 1983/84 figure was not available but since the total CHB produce revenue for 1983/84 was very similar to

1984/85 ($80,433 compared to $78,000) the 1984/85 revenue for Coronation ($13,343) was used.

The estimate of net annual expenditure for Coronation was $73,315 - $13,343 = $59,972.

The estimated cost per bed[3] per week = $\frac{\$59,972}{52 \times 141} = \$8.18$

An alternative cost estimate is obtained by allocating a share of total CHB cost, $411,648 in 1983/84, according to the percentage of beds at Coronation ($4.439%, see method A(i), table 8.11). This results in an estimate of cost per bed of only $2.49 per week. The difference between these two estimates reflects the extensive grounds at Coronation compared with other hospital sites. This is a benefit which patients can enjoy and the figure $8.18, estimates the actual cost of the facility provided. However it represents over-provision compared with other hospital sites and also with sites of long-stay geriatric care facilities planned for the future (see section 8.4.1), therefore the lower estimate, $2.49 will be used to estimate the cost of gardening for future long-stay care facilities in Canterbury.

---

[3]The cost is estimated per bed not occupied bed because this cost does not rise if occupancy rises. Hence $59,972 is the full cost of gardening a site for 141 beds. If all 141 beds were used for geriatric patients then the AOB would be close to 141, therefore the estimate $8.18 would be a good estimate of the weekly cost for a geriatric patient.

(3) Works maintenance

No information was available on specific costs or fraction of costs associated with Coronation Hospital. The Works Maintenance Department undertook tasks such as painting, carpentry, plastering, floorlaying etc. It is assumed that the amount of work generated is independent of the type of care taking place in a hospital but that it would be related to the physical size of the building and its level of use.

A percentage (3.137%) of total CHB expenditure on works maintenance ($1,895,443) was used to estimate the annual cost to Coronation. This allocates cost according to the percentage of "AOB + employees" [see method C(ii) table 8.11] and is an attempt to allocate costs according to the size of the hospital building and its use.

This method of estimation assumes that a similar relationship between work generated and "AOB + employees" exists for each type of hospital i.e., acute, long-stay etc.. No evidence exists to verify or refute this. However it is felt that estimates based on the number of beds would overestimate the costs to Coronation on account of the larger building space required to house operating theatres, laboratories etc., in acure hospitals. Similarly an estimate based on the number of employees would be an underestimate because the number of patients (higher in a geriatric hospital, relative to the number of staff) is not taken into account.

Using the percentage 3.137, the estimated annual expenditure on works maintenance at Coronation is $59,460 or $8.89 per occupied bed per week, for this type of work.

This value may underestimate the actual cost for Coronation because this hospital was older and may have required more maintenance than average, but it will be used as a reasonable estimate of the average cost of maintenance for long-stay care.

(4) Central Engineering

The central engineering service hold a staff of electricians, plumbers, fitters and other engineering tradesmen and was responsible for engineering repairs and maintenance. Outside contractors were used for some specialist work.

Coronation was served by engineering staff at a nearby acute hospital, who estimated that Coronation accounted for 20% of their time. Hence an amount $62,400 (20% of the total salaries for those staff, $312,000) was allowed for salaries. The staff identified certain major costs specific to Coronation. They were $2,800 for lift servicing, $500 for fire alarms and $500 for pumps, plumbing etc. There may have been other small items of expense, but those specified total $3,800 which together with the salaries component amount to $66,200, which is an estimate of Coronation's engineering expenditure in 1983/84.

Alternative methods of estimation viz. any of the methods A(i) to C(ii) of table 8.11, based on patient or staff numbers are hard to justify, on account of the greater costs in the acute hospitals (for the more specialized work). Estimates of annual expenditure using them range from $68,876 for method B (based on number of employees) to $94,434 for method C(ii) (based on number of AOB + employees) or $147,958 for method A(ii) (based on number of AOB). This last is obviously an overestimate because it ignores the difference between acute and long-stay hospitals. All three overestimate because the total CHB engineering expenditure, $3,010,344, used in their calculation includes the costs of the boiler house of one acute hospital, which shared the engineering maintenance site.

In the light of the foregoing considerations the estimate $66,200 of 1983/84 engineering expenditure will be used in spite of its deficiencies. This converts to an amount $9.90 per occupied bed per week.

(5) Central Administration

Central administration handled the payroll and accounts for all hospitals. It also housed senior personnel of the Canterbury Hospital Board. It is assumed that the work of this section is more closely related to the number of employees rather than the number of hospital beds. This implies that increases in patient numbers or beds are reflected at the hospital rather than the central administration level. Coronation accounts for 2.288% of total hospital personnel (table 8.11). Allocating this percentage of total expenditure on administration, $2,240,106 (table 8.10) yields an estimate of annual cost of $51,254 to Coronation. This is $7.65 per occupied bed per week.

(6) Supply

The supplies department handled the distribution of all non-pharmaceutical materials to the hospitals (e.g., paper towels, bin-liners etc.). The annual expenditure of the Supplies Department in 1983/84 was $460,919 (see table 8.10). Allocating a share of total CHB supply cost to Coronation of 3.137%, based on average occupied beds and personnel employed, (method C(ii), table 8.11) since it is related to the number of people in the building, would seem to be justified. This yields a cost to the hospital of $14,459 and a weekly cost per occupied bed of $2.16. Coronation received supplies twice a week using a similar method to that employed for laundry transport costs, the cost of transporting supplies is estimated at $0.25 per patient per week. This gives a cost of $2.41 per patient per week.

(7) Transport

The Transport Department was responsible for the movement of personnel (patients and staff) and goods to and from hospitals, clinics and CHB departments. It operated a fleet which included ambulances and trucks. The amount of goods movement e.g., supplies, laundry, can be expected to be related to the number of average occupied beds. However, there was very little movement of patients at Coronation compared with the acute hospitals, therefore a method of cost apportionment based only on the number of beds or AOB would not represent this and would be an overestimate. Similarly a method based on simply the number of employees might under-estimate costs because it does not allow for the greater numbers of patients per staff member in long-stay hospitals and so would underestimate goods movement.

Methods A(ii), B and C(ii) using percentages of costs 4.915, 2.288, and 3.137 (see table 8.11) resulted in cost estimates of $5.54, $2.58 and $3.54 per patient per week. The last estimate is probably the most reliable since it reflects the greater activity of the acute hospitals while taking into account the number of patients.

As an alternative approach the transport activities for Coronation were identified and costed separately. These were: the collection and delivery of laundry 6 days each week. This was costed at $1.50 per patient per week; delivery of supplies twice each week at $0.25 per patient per week; movements of patients to and from other hospitals. The cost of these movements are considered in the sections dealing with the cost of the service involved, e.g., laundry. No further allowance is made for transport costs.

Total cost of Hotel services provided centrally

The estimates of the cost of various central services are summarized in table 8.14.

TABLE 8.14

ESTIMATES OF WEEKLY COST PER PATIENT OF SERVICES PROVIDED CENTRALLY TO CORONATION HOSPITAL, 1983/84

Central service	Average cost per patient ($)	Cost related to dependency** ($)
laundry	26.60	11.60 + 6.34 t_1
gardening	2.49*(8.18)	2.49
works maintenance	8.89	8.89
engineering	9.90	9.90
central administration	7.65	7.65
supply	2.41	2.41
total central services	57.94(63.63)	42.94 + 6.34 t_1

* This is an estimate for a typical size of gardens. The actual cost for Coronation was, at $8.18, much higher.

** t_1 is the direct nursing care received by patient in 24 hours.

(c) Total Cost of Hotel Services

The estimates of the costs of on-site and centrally provided hotel services, (in tables 8.9 and 8.14), are combined to give the total cost of hotel services. These are shown in table 8.15. It can be seen that the hidden costs of central services add 50% to the costs of on-site services.

TABLE 8.15

ESTIMATES OF WEEKLY COST PER PATIENT
OF HOTEL SERVICES, CORONATION HOSPITAL 1983/84

Service	Average cost per patient ($)	Cost related to dependency* ($)
food and catering	41.84	41.84
energy	17.65	17.65
administration	15.38	15.38
cleaning	26.83	26.83
goods movements	12.49	12.49
telephone/rates/postage etc.	8.55	8.55
laundry	27.75	12.75 + 6.34 t_1
gardening	2.49(8.18)	2.49
works maintenance	8.89	8.89
central engineering	9.90	9.90
supply service	2.41	2.41
total hotel services	174.18(179.87)	161.43 + 6.34 t_1

* t_1 is the amount of direct nursing care required by patient in 24 hours.

8.5 NURSING CARE

8.5.1 Provision of the nursing resource

Nursing care was provided for the 117 geriatric patients and up to 16 respiratory patients by registered and unregistered nursing staff. The expenditure on nursing salaries in 1983/84 was $1,582,383, for 19.3 registered and 76.2 unregistered staff. The year 1983/84 was slightly atypical in that a senior post was vacant for part of the year. At the time of the data collection on patient care this post had been filled, the number of nurse aides had been reduced and a position for an orderly who performed nursing duties, had been discontinued.

The total expenditure in 1983/84 was adjusted to take account of these changes to give an estimate of $1,526,358. One ward, the annex, cared for respiratory as well as geriatric patients. The nursing care of the (short-stay) respiratory patients differed from that of the (long-stay) geriatric patients and to some extent resembled care in an acute hospital. Therefore in order to estimate the costs of geriatric care more precisely the annex nursing staff and their salaries were extracted from the totals for the hospital. The cost analysis which follows refers to the remaining three wholly geriatric wards each having 35 beds. The numbers of staff and salaries expenditure for 1983/84 for these three wards are shown in table 8.16.

The number of staff employed can be translated into the number of nurse duties available by taking into account sickness and other leave. 'Weekend' leave (or its equiv-

TABLE 8.16

CORONATION HOSPITAL - NURSE STAFFING LEVELS
AND SALARIES EXPENDITURE 1983/84
FOR THREE GERIATRIC WARDS

Grade of staff	Registered	Unregistered	Total
(i) numbers of staff employed (F.T.E.)	15.44	62.25	77.68
(ii) 1983/84 salaries expenditure ($)	348,329	924,350	1,272,679
(iii) nurse duties per day [(i)x0.6]	9.26	37.35	47.61
(iv) total nurse hours per day [(iii)x7½ hours]	69.467	280.125	349.592
(v) cost per hour 'on the ward' ($)	13.73	9.04	9.974
(vi) average hours per patient	0.670	2.703	3.373

alent) 'loses' two working days in seven, (28.5% loss). Holiday leave varied from 27 to 32 days for day staff and 32 to 37 days for night staff according to length of service. Absence due to sickness averaged 8.84 duties per unregistered nurse in 1984, but was less for registered nurses.

A total amount for sickness and holiday leave of 42 days was allowed, i.e. a loss of 11.5%. The total loss, due to leave of all types, is estimated at 40%. Therefore the average number of nurse duties available per day can be estimated by multiplying the numbers of nurses employed by 0.6[4]. This is shown in row (iii) of table 8.16. Each nurse duty approximated 7½ hours after allowing for meal breaks.

---

[4]The amount added on to allow for sickness and leave is 19.2% (11.5/60). This is close to estimates used by the nursing profession in manpower planning (Ball and Goldstone, 1984, Bell and Storey, 1984, Wiseman, 1984).

The total nurse hours per day available[5] for patient care can easily be calculated as can the cost per hour 'on the ward'. These are shown in rows (iv) and (v) of table 8.16.

8.5.2 Estimation of the average cost of nursing care

The average cost of nursing care per occupied bed for the year 1983/84 can be calculated from {annual expenditure/AOB}.

The average number of occupied beds for the three geriatric wards was 103.635. Therefore the estimate of average annual cost per patient for nursing care during 1983/84 is $\frac{\$1,272,679}{103.635} = \$12,280.4$ or \$235.5 per week.

This cost 'pays for' the average amount of nursing time available per patient. This is given by:

$$\frac{\text{total nurse hours available}}{\text{average occupied beds}} = \frac{349.592}{103.635} = 3.373 \text{ hours per day}$$

This time is for the patients' share of all nursing tasks i.e., direct or individual patient care, patient supervision, nursing administration, meals distribution etc. If a patient receives more or less than this amount of care then the nursing costs for that patient will differ.

For the purposes of cost estimation the tasks involved in nursing care will be divided into two groups, under the headings of direct and indirect care. In the next two sections the extent to which usages of these two types of care vary between patients will be discussed, and methods of estimating their costs will be developed.

---

5 The staffing levels on the three wards (two women's, 1 men's) were the same yet the men were less dependent (see chapter 7). This point is discussed in the appendix to this chapter.

8.5.3 Estimation of the cost of direct care

Direct care refers to patients' personal care i.e., bathing, toileting, feeding etc. It also includes an element of medical care, i.e., medication, injections and wound dressings. These tasks are particular to the individual patient and take place on a one-to-one or sometimes two(nurses)-to-one(patient)-basis.

The direct nursing time, t_1, was measured for each geriatric patient and ranged from 0.25 to 5.35 hours in 24 hours. The average direct nursing time, $\bar{t}_1$, was 2.33 hours (140 minutes) per patient with a standard deviation of 1.18 hours (71 minutes). This indicates substantial variation in the use of this resource (see figure 7 .1).

It has been demonstrated (chapter 7, and Green and Rayner, 1985) that the usage of direct nursing time can be related to the extent of a patient's disabilities (i.e., with toileting, mobility, dressing, washing, etc.). Clearly any estimate of the cost of direct care must be a variable cost estimate.

Using the average direct care time of 2.33 hours, the total time spent on direct care for ALL patients each day would be 241.815 hours (which is 69.17% of the total 349.592 nurse hours available). The cost of this direct care depends upon the grade of staff employed. If one assumes (A) that all staff spend 69.17% of their time on direct care then the unit cost of direct care, C_1, is $9.97 per hour [see table 8.16]. However some senior staff were heavily involved in administrative duties and therefore the percentage of their time spent on direct care may have been less. An alternative assumption (B) is that all direct care is undertaken by unregistered nurses and therefore to use their unit cost of $9.04 per hour. This is not entirely the case either because much of the medical care could be conducted only by registered staff. Both methods are used for cost estimation. Method (A) overstates the variability in cost; method (B) understates the variability in cost of direct care between individual patients. Table 8.17 shows the results of using each method in estimating the weekly cost of direct care. This cost is $7C_1t_1$.

TABLE 8.17

ESTIMATES OF WEEKLY COST OF DIRECT NURSING CARE FOR INDIVIDUAL PATIENTS, CORONATION HOSPITAL 1983/84

	t_1 Direct nursing care (hours in 24 hours) received by patient	Weekly cost of direct care for patient {\$$7C_1t_1$}	
		Method A (C_1 = \$9.97)	Method B (C_1 = \$9.04)
	0	0	0
	0.5	34.91	31.64
	1.0	69.82	63.28
	1.5	104.73	94.92
	2.0	139.63	126.57
mean →	2.33	162.91	147.66
	2.5	174.54	158.21
	3.0	209.45	189.85
	3.5	244.36	221.49
	4.0	279.27	253.13
	4.5	314.18	284.77
	5.0	349.09	316.42
	5.5	383.99	348.06
	6.0	418.90	379.70

Whichever method is used, the results show the importance in costing out direct care received by individual patients. The costs of this care vary tremendously from one-fifth of the average cost (for patients having only half an hour of direct care) to more than double the average cost for the very dependent patients. The cost difference between the very dependent patient (those receiving over 4 hours of direct care per day) and the average patient is at least $100 per week and could reach $200 in some cases.

8.5.4 Estimation of the Cost of Indirect Care

(a) Methods of estimation

All nursing care which is not specific to one patient, but is undertaken for several patients, or which does not involve direct patient contact is grouped together under the heading indirect care. Its three major components are nursing administration, patient supervision (e.g. at night) and domestic tasks undertaken by nursing staff.

The total amount of time not spent on direct care was 107.78 hours per day (1.04 hours per patient) accounting for 30.83% of nurse time.

Two methods of estimating the share of the cost of indirect care to the individual patient will be used. The first method (I) is to allocate costs equally between the patients. This uses the mean cost of indirect care as the estimator. This rests on the assumption that every patient regardless of the level of disability receives the same share of indirect care.

The second method (II) is to allocate indirect care costs in proportion to direct care costs. This takes account of disability levels and assumes that more dependent patients receive more indirect care.

(b) Validity of estimation methods

The validity of the two methods of estimation of the cost of indirect care are now discussed with respect to the main indirect care tasks.

(1) Nursing Administration

In the hospital studied, nursing administration was undertaken by registered nurses. It formed the whole time of the principal nurse and the major portion (about 60%) of the assistant principal nurse's time. Part of the ward sisters' workload included administrative duties (e.g., drugs and supplies management, patient care plans, staff rosters, etc.). The total time spent on administrative tasks varied from day to day but formed less than one-third of all indirect care time and less than 10% of total workload of the nursing staff. Although all nursing administration is undertaken ultimately for the patients it can be considered to depend on two factors; the number of patients and the number of nursing staff, i.e., part of the work depends simply on the number of patients to be cared for and the share of its cost would justifiably be equal for each patient. Any tasks which increase with the number of nursing staff employed (e.g., hiring of personnel, staff rosters, staff education etc.) are related to the dependency of the patient and the share of these costs should be greater for the more dependent patients. No attempt has been made to identify the proportion of nursing administration which is dependent on the number of nursing staff employed.

Method I of estimation will underestimate the cost of indirect care for the more dependent patient and overestimate for the less dependent patient. Method II will produce the opposite effect. The true cost of nursing administration for the individual patient would lie between the two estimates.

(2) Patient supervision

In hospital care, there are nurses on duty at all times. Patient supervision is provided specifically at certain times e.g., during meals and at night when although no care tasks may be performed, nurses are available to give help where necessary. It is offered in a 'secondary' sense (as an externality) when a nurse carrying out a domestic task is aware of the welfare of the patients around her, and a nurse giving direct care to one patient may be supervising another. The time when a nurse is on duty but not undertaking a specific care or domestic task is a further source of supervision time.

The justification for using method I to estimate cost would be that all hospital patients require equal 24 hour supervision so that differences in total care time are accounted for by differences in direct care time. Method II implies that the more dependent patients require a higher nurse to patient ratio for supervision. The opinion of the ward sisters was that method I was nearer to the true state of affairs. They felt that allocating supervision in proportion to direct care time (method II) would seriously understate the supervision required for some patients who used a small amount of direct care time, particularly the forgetful or confused but physically able patient.

(3) Domestic Tasks

A certain amount of domestic work, e.g., the serving of food and drink, cleaning of lockers, wheelchairs and mackintoshes etc., was carried out by the nursing staff (usually by enrolled nurses or nurse aides). Handling of food and supplies was limited to the ward area; orderlies were responsible for movement to and from the wards. Major cleaning (floors, walls, etc.) was undertaken by domestic staff and the orderlies. The hours spent by nursing staff on domestic tasks varied from day to day. It depended upon the number of staff on duty, the ward routine (some tasks were completed on only one day each week) and the direct care demands of the patients. Clearly certain tasks had to be done every day, e.g., distributing meals, but the policy of the hospital was that patient care had priority and domestic tasks were delayed and rescheduled when patient care workloads were high.

A small data collection was undertaken to roughly estimate the amount of time nurses spent on domestic work. Information was collected over one 24 hour period for each ward. The time spent ranged from 27 to 38 nurse hours (47 to 65 minutes per patient) and accounted for the major portion of nurses' time spent on indirect care (at least 70%), and at least 22% of total nursing time.

The nature of most of the domestic tasks was such that the work generated by each patient was approximately equal and method I, allocating a constant cost per patient, would be justified. This would be the case for example, for meals distribution. Other tasks, e.g., scrubbing of wheelchairs, feeders, etc., were performed only for the more dependent patients and method II, allocating costs in proportion to dependency, would be more appropriate.

(c) Cost of indirect nursing care

The estimates of the cost of indirect care will depend not only on the method (I or II) of estimation but also on the assumption (A or B) made in section 8.5.3 with respect to the nature of tasks performed by various grades of staff.

(1) Method I

The assumption here is that indirect care is consumed equally by all patients. The amount of indirect care can be estimated by the mean, 1.04 hours per patient per day.

If assumption A is made, i.e., that staff of all grades spend the same percentage of their time on direct care (69.17%) then C_2, the cost per hour of indirect care is equal to the cost of direct care, C_1. Both equal the average cost per hour of nurse time, \$9.974. The cost of indirect care per week = 7 x 1.04 x \$9.974. This is \$72.611 per patient per week. If assumption B is made, i.e., that direct care is provided by unregistered staff then the cost of the remaining (indirect) care is \$12.065

per hour.[6] This is larger than the cost of the direct care ($9.04) because of the higher salaries of the (registered) staff, who provide part of it. The cost of indirect care per week = 7 x 1.04 x $12.065. This is $87.83 per patient per week.

(2) Method II

This method is based on the assumption that indirect care, t_2, is consumed in proportion to direct care, t_1.

i.e. $$t_2 = \frac{t_1}{\bar{t}_1} \cdot \bar{t}_2 \qquad \text{.......... 8.1}$$

For the hospital studied $t_2 = \frac{t_1}{2.33} \cdot 1.04$, hours per day.

The cost per unit of indirect care, C_2, is $9.974 under assumption A, and $12.065 under assumption B. Table 8.18 shows the weekly cost of indirect care for individual patients, based on different values of direct care received.

---

6 This is calculated by:

$$\text{Cost per hour of indirect care} = \frac{\text{average weekly cost of nursing care per patient} - \text{weekly cost or direct care}}{\text{hours of indirect care provided per week}}$$

$$= \frac{\$235.5 - \$9.04 \times 2.33 \times 7}{1.04 \times 7}$$

$$= \$12.065$$

TABLE 8.18

WEEKLY COST OF INDIRECT CARE FOR PATIENTS - METHOD II OF ESTIMATION. CORONATION HOSPITAL 1983/84

t_1 direct care (hours in 24 hours)	t_2 indirect care (hours in 24 hours)	estimates of weekly cost of indirect care ($)	
		AII (C_2=\$9.974)	BII (C_2=\$12.065)
0	0	0	0
0.5	0.22	15.56	18.82
1.0	0.45	31.12	37.64
1.5	0.67	46.67	56.46
2.0	0.89	62.23	75.28
mean → 2.33	1.04	72.61	87.83
2.5	1.11	77-79	94.10
3.0	1.34	93.35	112.92
3.5	1.56	108.90	131.74
4.0	1.78	124.46	150.56
4.5	2.01	140.02	169.37
5.0	2.23	155.58	188.19
5.5	2.45	171.14	207.01
6.0	2.67	186.69	225.83

8.5.5 Estimation of the total cost of nursing care

The two methods (A and B) for estimating direct care costs, can be combined with the two methods (I and II) for indirect care cost estimation, yielding four estimates of total nursing care costs.

Using the notation introduced in the previous sections of C_1 and C_2 for the hourly costs of direct and indirect care and t_1 and t_2 for the hours of direct and indirect care received by a patient in one day, then the weekly cost of nursing care for an individual patient is given by:

$$\text{ncost} = 7(C_1t_1 + C_2t_2)$$

The four estimates based on the combination of assumptions A, B and I, II are

$$AI : ncost = 7(9.974)t_1 + 72.61$$

$$BI : ncost = 7(9.041)t_1 + 87.83$$

$$AII : ncost = 7[(9.974)t_1 + 9.974t_2]$$

$$BII : ncost = 7[(9.041)t_1 + 12.065t_2]$$

These estimates are plotted in figure 8.1.

Estimates AII and BII are equivalent, on account of the relationship between t_2 and t_1, assumed under II

i.e. $$t_2 = \frac{t_1}{\bar{t}_1} \quad \bar{t}_2 \qquad \text{\_\_\_\_\_\_\_ } 8.1$$

Under A, $C_2 = C_1 = \bar{C}$ (average cost of nursing care per hour)

Therefore daily nursing cost $= \bar{C}(t_1 + t_2)$ _______ 8.2

Under B, C_1 and C_2 vary. However the total cost of direct and indirect care <u>for all patients</u> is fixed.

i.e. $$\sum C_1 t_1 + \sum C_2 t_2 = \sum \bar{C}(t_1 + t_2)$$

$$\therefore \quad C_1\bar{t}_1 + C_2\bar{t}_2 = \bar{C}(\bar{t}_1 + \bar{t}_2)$$

$$\therefore \quad C_2 = \frac{\bar{C}(\bar{t}_1 + \bar{t}_2) - C_1\bar{t}_1}{\bar{t}_2}$$

The daily cost of nursing care for a patient

$$= \quad C_1 t_1 + C_2 t_2$$

$$= \quad C_1 t_1 + \left(\frac{\bar{C}(\bar{t}_1 + \bar{t}_2) - C_1\bar{t}_1}{\bar{t}_2}\right) . \left(\frac{t_1}{\bar{t}_1} . \bar{t}_2\right)$$

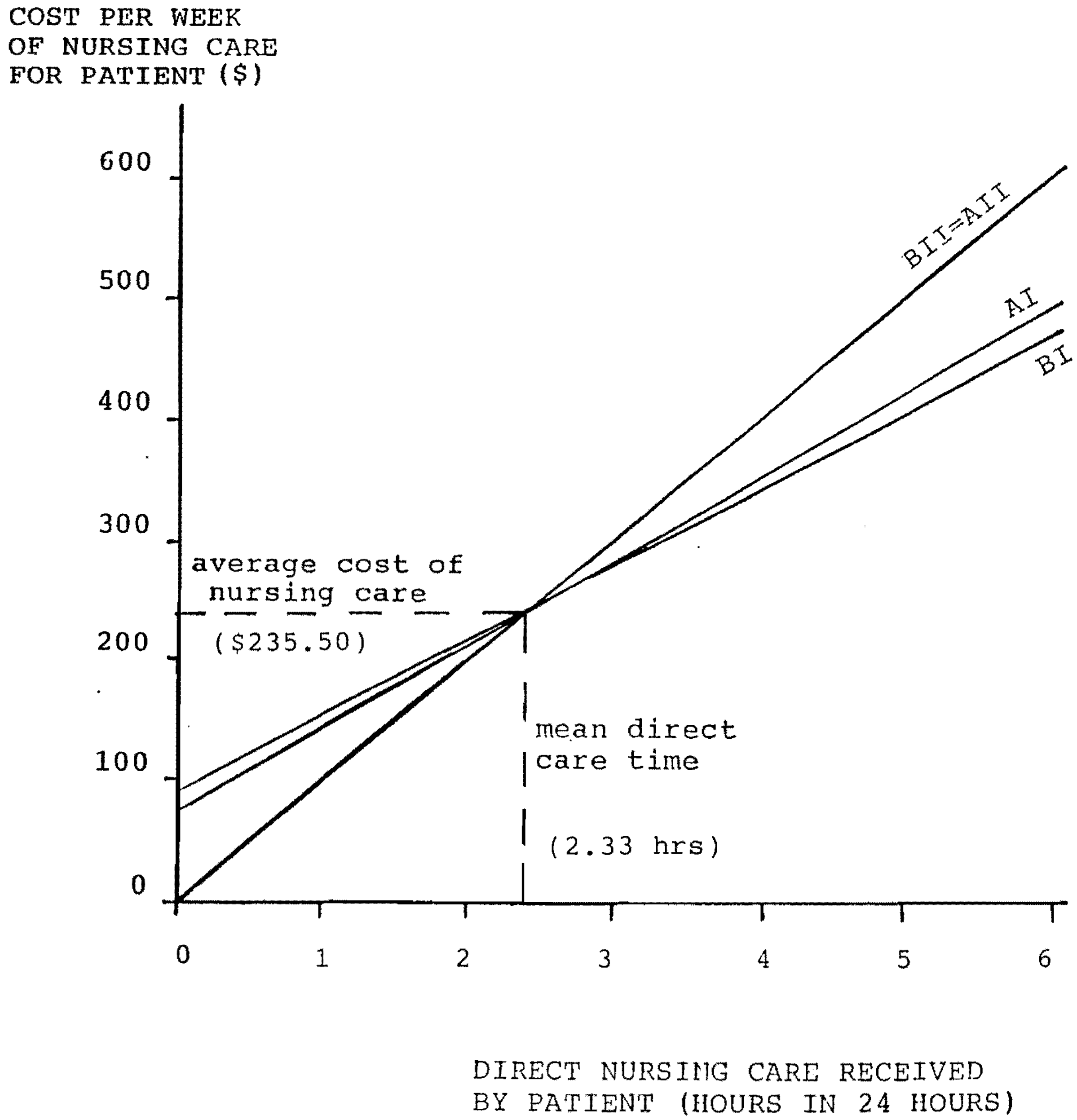
$$= \quad C_1 t_1 + \bar{C}\frac{(\bar{t}_1 + \bar{t}_2).t_1}{\bar{t}_1} - C_1 t_1$$

$$= \quad \bar{C}\ t_1 + \bar{C}\ \frac{\bar{t}_2.t_1}{\bar{t}_1}$$

$$= \quad \bar{C}\ t_1 + \bar{C}\ t_2 \qquad \text{\_\_\_\_\_ } 8.3$$

Figure 8.1

COMPARISON OF FOUR ESTIMATES OF WEEKLY COST
OF NURSING CARE FOR INDIVIDUAL PATIENTS
CORONATION HOSPITAL 1983/84



This is identical to 8.2 and the two methods of estimation AII and BII are equivalent. Having made the assumption (II) that indirect care is in proportion to direct care then the cost of all nursing care received is independent of the choice of assumption (A or B) concerning the grade of staff enacting the tasks. Of course the relative costs of direct and indirect care do depend on the choice of A or B. (see figure 8.2). Their sum does not.

8.5.6 Selecting a method of estimation

The four methods of cost estimation just derived relate the costs of nursing care to the amount of direct care received by a patient. The objective of this chapter is to relate cost to patient dependency. In chapter seven the relationship between direct nursing care (t_1) and patient dependency was explored and a model was developed relating t_1 to disability measures (X_1, X_2 etc....)

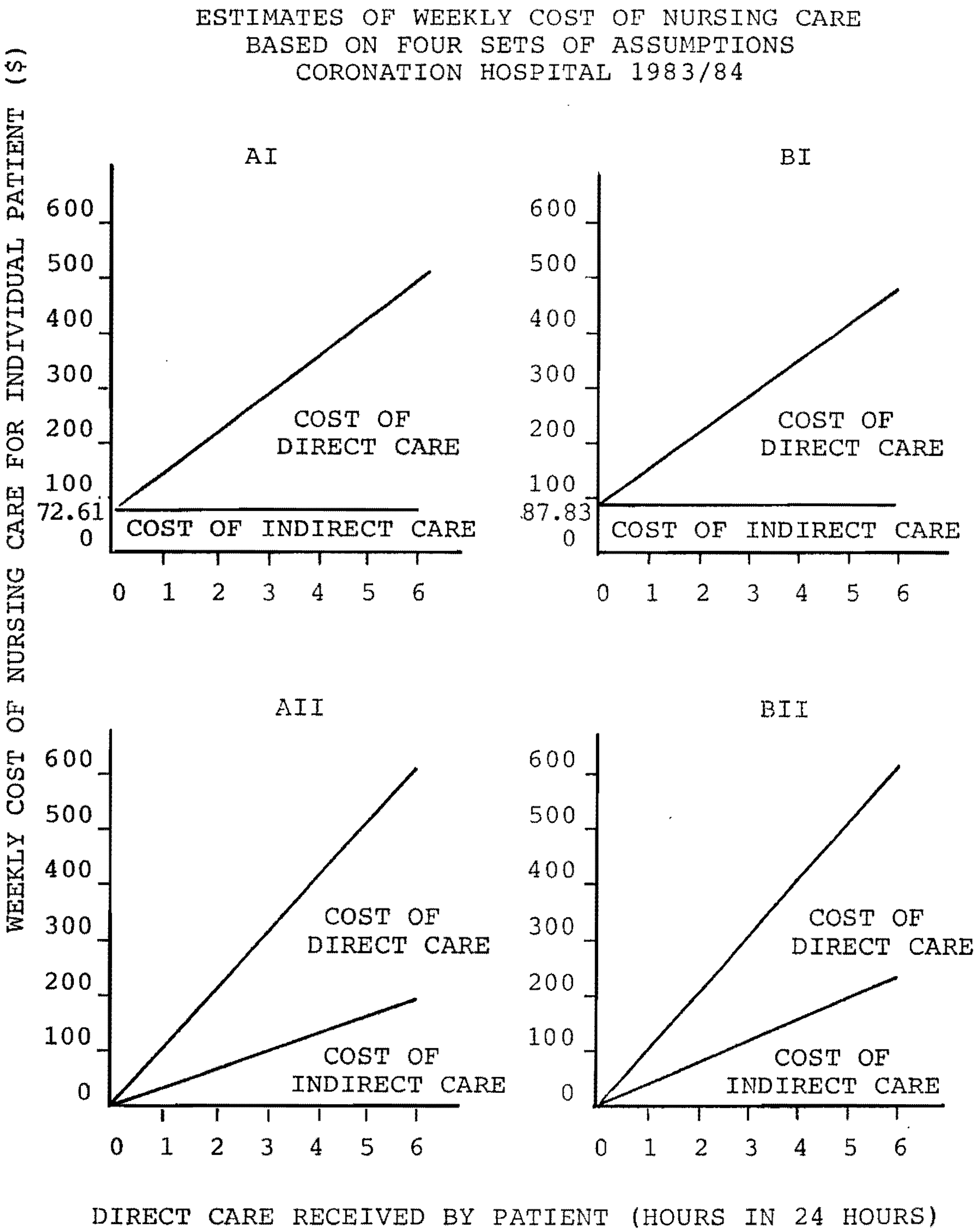
i.e. $\hat{t}_1 = \sum b_i X_i$

where $\hat{t}_1$ estimates t_1, and $\{b_i\}$ are constants.

This model explained 72% of the variability in t_1 for the patients at Coronation hospital. This model can be used to convert the four methods of cost estimation of 8.5.5 so that they relate nursing cost to patient dependency. This is achieved simply by replacing t_1 by $\sum b_i X_i$, the weighted sum of disability scores. When selecting a method of cost estimation it is useful to focus on t_1 as a measure of patient dependency.

Methods AII and BII of estimation, portray the greatest variability in nursing care costs between patients

Figure 8.2



A : direct care is costed at average nursing salary rates
B : direct care is costed at unregistered nursing salary rates
I : the cost of indirect care is the same for each patient
II : the cost of indirect care varies with patient dependency.

of different disabilities. The weekly cost ranges from zero for an independent patient to \$605 for a highly dependent patient. A value of zero for direct care was not observed in the sample results, although there were several patients who received less than 30 minutes of direct care. The small values for indirect care costs (less than \$15) seem unlikely. An amount of domestic work and nursing administration would be performed for even these 'least' dependent patients. Examining the other end of the curve, for the heavily dependent patient, it can be seen that the cost of indirect care is much higher than for the least dependent patients. However, since over 70% of indirect care time is spent on domestic tasks and since for most of these, the share to patients is equal, then if the cost of indirect care is higher for the dependent patients it would only be slightly so. This argument leads to a rejection of method II in favour of method I. Therefore methods AII and BII will not be used in any further analysis.

Methods AI and BI produce results which are quite similar to each other. Method BI is the most conservative (of all four methods) in that it understates the variability of the cost of nursing care between patients of different disabilities. The cost ranges from \$87.8 to \$467.5 per week for different patients. Each patient has an equal 'share' of registered staff because these costs are allocated evenly over all patients. However the true variability between patients may be underestimated, because the more dependent patients are allowed only more unregistered nurse time. If these patients also require more time from registered staff (compared with less dependent patients) then their costs will be relatively higher.

Method AI allows the more dependent patients a greater share of (the more expensive) registered staff and so this method will be used to estimate the costs of nursing care for long-stay patients. Table 8.19 tabulates total weekly costs of nursing care for all four methods.

TABLE 8.19

ESTIMATES OF WEEKLY COST OF NURSING CARE FOR PATIENTS, CORONATION HOSPITAL 1983/84

t_1 direct care (hours in 24 hours)	selected method AI ($)	other methods of estimation BI ($)	AII and BII ($)
0	72.61	87.83	0.00
0.5	107.52	119.47	50.46
1.0	142.43	151.11	100.92
1.5	177.34	182.75	151.38
2.0	212.25	214.39	201.84
mean → 2.33	235.52	235.50	235.50
2.5	247.16	246.03	252.30
3.0	282.07	277.67	302.76
3.5	316.98	309.31	353.22
4.0	351.89	340.95	403.67
4.5	386.80	372.59	454.13
5.0	421.71	404.23	504.59
5.5	456.62	435.87	555.05
6.0	491.51	467.51	605.51

For the method selected, AI, the costs of nursing care vary substantially according to the dependency of the patient. For the sample studied the range in cost would be from $90 for the least dependent to $445 for the most dependent patient observed. These figures represent large departures from the average cost of nursing care of $235.5 per patient. The differences are -$145 and +$210 per week.

Very few patients had these extremes of dependency, however. But the hospital did have 17.1% of patients who received less than one hour of direct care in 24 hours. For these the costs of nursing care are less than $142 per week, i.e., $100 less than the average cost; similarly the 9.4% of patients who received over four hours of direct care in 24 hours cost at least $352 a week, $100 more than the average. Clearly when estimating nursing care costs for individual patients it is very important to take into account the level of dependency. When determining the nursing costs of groups of patients it is necessary to be aware of the 'disability mix'.

8.5.7 Orderly - 'nursing' costs

Although nursing staff, in the hospital studied, escorted or wheeled patients in the ward, orderlies were responsible for patient movements off the ward, i.e., to and from physiotherapy, occupational therapy and specialist treatment. In some hospitals (including many private hospitals in New Zealand) these tasks would be performed by nurses. The costs of this service are therefore included here. Orderlies spent approximately 15% of their time moving patients. The annual cost of this is estimated at $24,099 (see footnote to table 8.7) or $3.66 per patient per week. The annex patients (12 geriatric, up to 16 respiratory) are included in this calculation. The respiratory patients were less likely to attend therapies but were more difficult to move when they did. Moreover movements due to admissions and discharges were more common for these (short-stay) patients. Hence the net effect on the average cost would be small.

8.6 MEDICAL CARE

Two resources are included in this section: doctor time and pharmaceuticals and dressings.

8.6.1 Doctor time

In public geriatric hospitals, each patient is under the care of a hospital doctor, who prescribes the level and type of any medications and is responsible for the medical care. In the hospital studied care was provided by a specialist geriatrician who made regular rounds of the wards and could be called upon to visit individual patients at other times at the request of the ward sister.

The average cost of doctor care per patient per week was $2.90. The usage of doctor time varied from patient to patient. Although all patients would be seen for chronic problems at least every three months, consultations for some chronic conditions could be as often as every two to three weeks and for acute problems three to four times a week. Usage for individual patients also varied from week to week according to short-term conditions which might occur, e.g., influenza. The time for consultation would be greater for those with multiple problems. However it was the opinion of the geriatrician that the assumption that each patient used equal amounts of his time was broadly correct. Therefore the average cost per patient, $2.90 will be used here. Since this cost is small compared with other costs of long-stay care, even large variations from the 'average' amount of care would have little effect on the total cost of an individual patient's care.

The cost of doctor care just estimated refers only to the cost of doctors working at the long-stay hospital, i.e., for the regular, ongoing medical care provided as part of the hospital 'package'. Other medical care was received by patients when necessary at general hospitals, e.g., surgical operations. The costs of these specialist procedures are not included in this study. Such costs are incurred and should be added to the regular costs of long-stay hospital care to determine the full costs of care. The objective of this thesis, however, is to compare the costs of care in different care environments. The cost of any care received in an acute hospital is not included in the costs for any mode of care. When making cost comparisons between modes of care it will be assumed that if a patient has a particular medical condition which requires treatment in an acute hospital, then the likelihood of getting that treatment will be the same whatever the mode of care. The implication for long-stay hospital care is that in this care mode the chance of a patient (with a medical condition) going to an acute hospital is no more or less than for a patient living at home. If this is so then the cost of the acute care received is similar and does not affect the outcome of any cost comparisons between modes of care. The validity of this assumption will be discussed in more detail in chapter 11.

8.6.2 Pharmaceuticals and dressings

The average cost per patient for these items was $7.69 per week. The type, dosage and number of drugs prescribed varied between patients. The cost of each drug also differed. Therefore the cost of pharmaceuticals and dressings would vary from one patient to another. A detailed study of prescriptions would be necessary to estimate the cost for individual patients, and to determine what relationship (if any) this had to measures of patient dependency. No such data was collected. However information was recorded on the frequency with which each patient received medications in one day. The results are shown in table 8.20. The mean value of n was 2.205 and the standard deviation was 1.256.

TABLE 8.20

FREQUENCY OF RECEIVING MEDICATIONS FOR INDIVIDUAL PATIENTS, CORONATION HOSPITAL

number of times medications given (n per day)	0	1	2	3	4	5	6
%age of patients receiving medication, n times per day	11.1	13.7	37.6	22.2	12.8	1.7	0.9

The distribution is positively skewed. There is insufficient evidence to infer from this that the cost for an individual patient varies in the same manner. The cost could be identical for two patients, one receiving an expensive drug infrequently, the other a cheaper drug more often. However it is clear that very few patients received no medications and that the bulk of patients received them two or three times a day.

In the absence of other information, the average cost of pharmaceuticals, $7.69 per week will be used in estimating the costs of drugs in long-stay public hospital care. The implications of this when comparing costs between modes of care will be discussed in chapter 11.

8.7 OTHER HEALTH PROFESSIONAL CARE

The services of other health professionals were provided in the hospital studied. These were physiotherapists, occupational therapists, chiropodist, dentist, social worker and speech therapists. The costs of these are considered below.

(1) Physiotherapy

Physiotherapy was provided on a group and individual basis. Most patients were involved in some way. Some patients, particularly those receiving individual care, used more therapy time than others and for these the costs of care would be higher. The average cost of physiotherapy was $2.97 per patient and since this is such a small component of cost it will be used to estimate the cost for each patient.

(2) Occupational therapy

A regular programme of group therapy was organized each weekday in the hospital studied. Very few patients did not participate. These would be the very sick or the very mentally confused. In addition, individual sessions were arranged for some patients. This was for very few patients however and did not involve substantial staff time therefore the average cost of occupational therapy, $4.36 per week will be used for all patients.

(3) Chiropody

A chiropodist visited patients when necessary and provided treatment. The cost was borne by the Canterbury Hospital Board and averaged $0.10 per patient per week.

(4) Dentistry

A dental service was provided free of charge to patients. It was not possible to identify the cost to the Hospital Board of the treatment received by Coronation patients. Therefore this cost is not included in the total cost of care.

(5) Speech Therapy

A speech therapist provided care to a very few patients. This cost is not included in the total cost of care. It is assumed (in the same way as for specialist treatment in general hospitals) that access to speech therapy would be similar whatever the mode of care of the patient.

(6) Social Work

The services of social workers from a general hospital were employed in two main capacities: at the time a person enters long-term care, to facilitate the transition from the previous accommodation to the hospital; after entry to provide support to both the patient and relatives enabling them to cope with the new situation. The average cost per patient was $0.73 per week.

8.8 THE TOTAL COST OF LONG-STAY CARE RELATED TO PATIENT DEPENDENCY

The cost estimates of the main components of care are now grouped together to provide estimates of the total cost of long-stay care of the elderly in public hospital. Two types of estimates have been obtained: the cost of the current provision of long-stay care and the cost of future provision. The costs for these estimates are presented in table 8.21. Capital and operating costs are shown separately.

The cost of current provision is made up of the operating costs for Coronation Hospital and the capital value of the land, buildings, and equipment of the existing hospital site.

The estimate of the cost of future provision is consistent with present policy on long-term care i.e., to provide long-stay units on the sites of existing general hospitals. The capital costs shown are for the construction of new units. The operating costs are estimated from those of Coronation Hospital and differ from them only in the case of gardening (where the estimate is lower to take account of the smaller grounds to be provided in the future).

Two sets of figures are shown in table 8.21: the average cost per patient and the cost for an individual

TABLE 8.21

WEEKLY COSTS PER PATIENT OF PUBLIC HOSPITAL LONG-STAY CARE RELATED TO PATIENT DEPENDENCY, 1983/84

	Average cost per patient $		Cost for individual patient receiving t_1 hours of direct care $
(a) Current Provision - Coronation Hospital			
Operating Costs		%	
Hotel Services	179.87	41	$167.12 + 6.34t_1$
Nursing Care (1)	239.18	55	$76.27 + 69.82t_1$
Medical, therapy care	18.75	4	18.75
Total operating costs	437.80	100	$262.14 + 76.16t_1$
Capital Costs (3)			
Land, buildings, equipment (market value)	26.11		26.11
Total Cost	463.91		$288.25 + 76.16t_1$
(b) Future Provision - replacement			
Operating Costs			
Hotel Services	174.18 (2)		$161.43 + 6.34t_1$
Nursing Care (1)	239.18		$76.27 + 69.82t_1$
Medical, therapy care	18.75		18.75
Total operating costs	432.11		$256.45 + 76.16t_1$
Capital Costs (3)			
Land, buildings, equipment (replacement value)	124.11		124.11
Total Cost	556.22		$380.56 + 76.16t_1$

(1) This includes a small amount, $3.66 for the patient movements carried out by orderlies.

(2) This cost uses an estimate $2.49 of the cost of typical gardening cost instead of the actual cost of $8.18 for Coronation.

(3) Capital costs presented here are based on a discount rate of 10% which is the rate used by the Department of Health in the evaluation of Health Services projects.

patient based on t_1, the amount of direct nursing care received. Figures 8.3 and 8.4 illustrate the variation in total cost over the range of observed values of t_1. Since t_1 is related to the level of a patient's disabilities then the cost estimates obtained relate cost to patient dependency.

Figures 8.3 and 8.4 also illustrate the relative contribution to total cost of the different components of care. Part of the total cost ($286 for current provision) is fixed per patient i.e., is incurred regardless of level of dependency. As a patient becomes more dependent (and t_1 increases) the nursing (and laundry) costs increase. For a patient requiring 4 hours of direct nursing care per day the total resource costs of care (current provision) are $570 per week, of which $356 are nursing costs. This can be compared to the total cost of $362, which includes $146 for nursing care, for a patient requiring 1 hour of direct care. Table 8.22 summarizes these cases and compares them with the average patient.

The figures in brackets refer to the cost components as a percentage of total cost. Nursing care which comprised 40% of total cost for the 'less dependent' patient has reached 60% for the very dependent patient. The variable cost component has risen from 21% to 50% of total cost for these two types of patients. This leads to considerable variation in total cost. Total cost has risen from $362 to $590 per week, an increase of 61%. Most of this is on account of the higher nursing costs for the very dependent patient which are more than double those of the less depend-

Figure 8.3

WEEKLY COST OF LONG-STAY PUBLIC HOSPITAL CARE
OF THE ELDERLY (CURRENT PROVISION)
1983/84

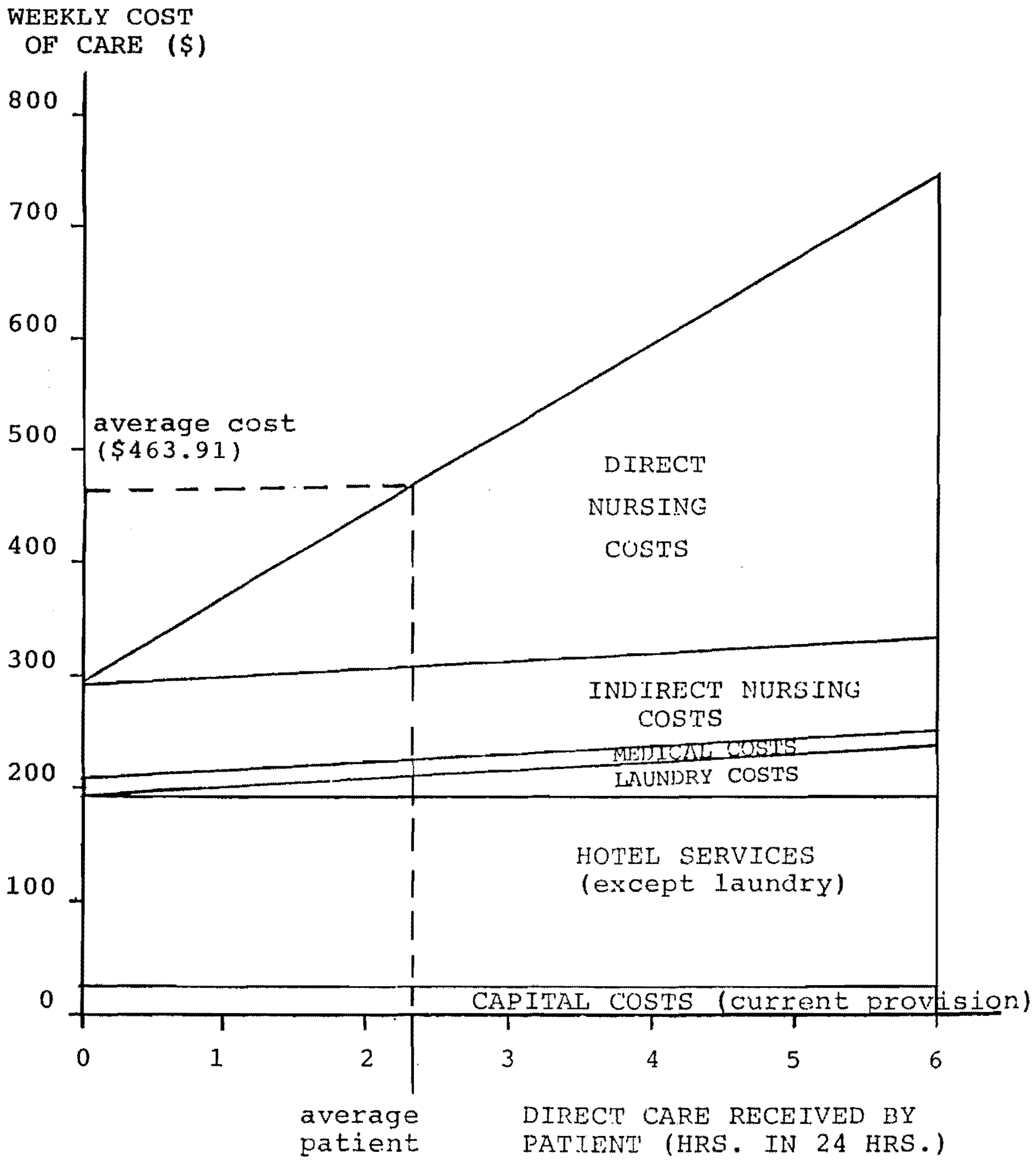


Figure 8.4

WEEKLY COST OF LONG-STAY PUBLIC HOSPITAL
CARE OF THE ELDERLY (REPLACEMENT)
1983/84

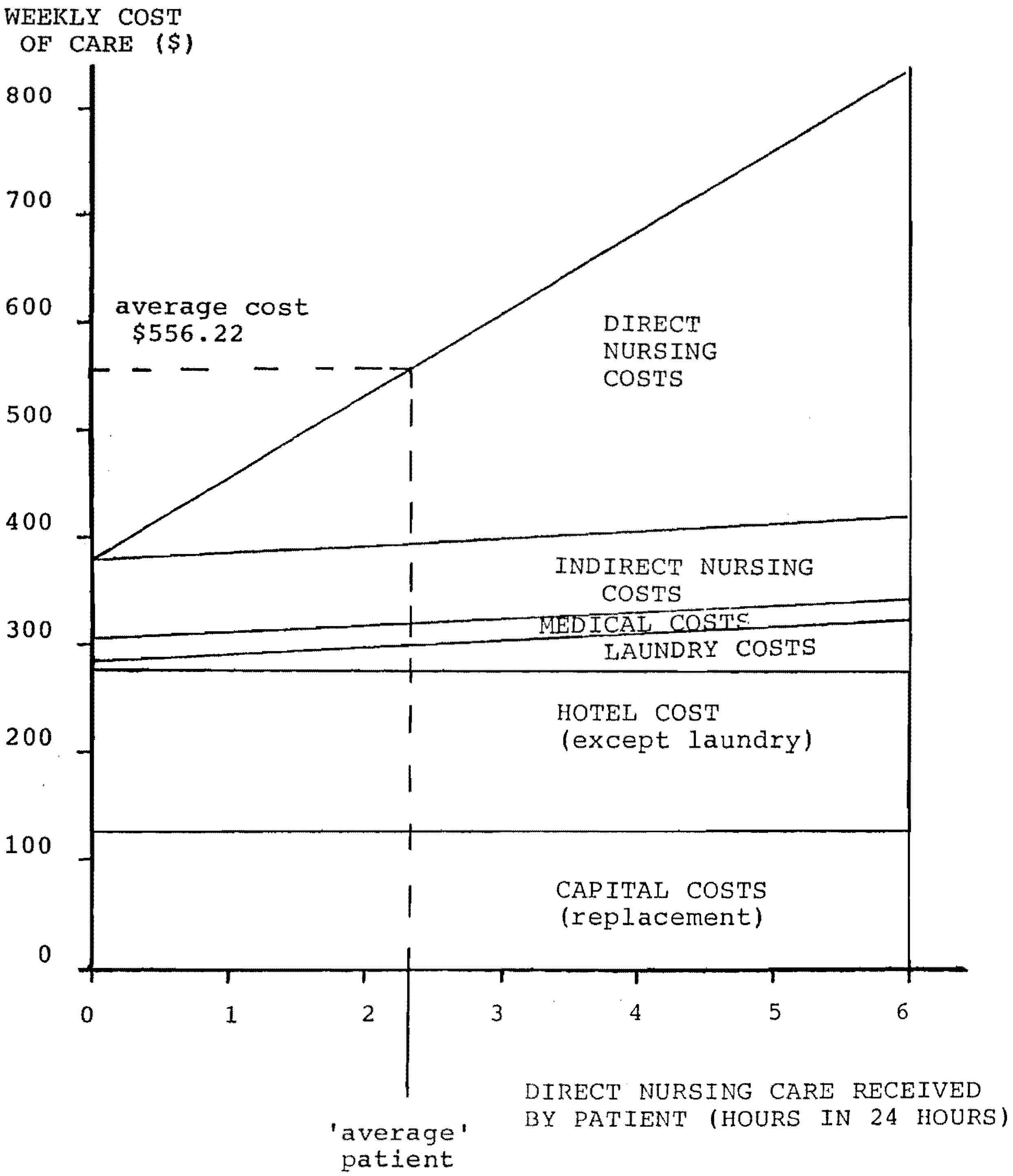


TABLE 8.22

BREAKDOWN OF WEEKLY COSTS OF CARE FOR PATIENTS
AT DIFFERENT LEVELS OF DEPENDENCIES
(CURRENT PROVISION)

	less dependent patient	average patient	very dependent patient
t_1, direct nursing care(hrs)	1	2.33	4
nursing costs (1) ($)	146 (40%)	239 (52%)	356 (60%)
fixed cost ($)	289 (79%)	289 ($62%)	289 (49%)
variable cost ($)	76 (21%)	175 (38%)	304 (51%)
Total cost ($)	365 (100%)	464 (100%)	593 (100%)

(1) This includes a fixed nursing cost of $76.

ent patient. The range in both nursing and total costs for the 117 patients observed at Coronation Hospital is in fact greater than that shown in table 8.22, since direct care times less than 1 hour and greater than 4 hours were observed.[7] The variation in cost for the 117 patients at Coronation is illustrated in figure 8.5.

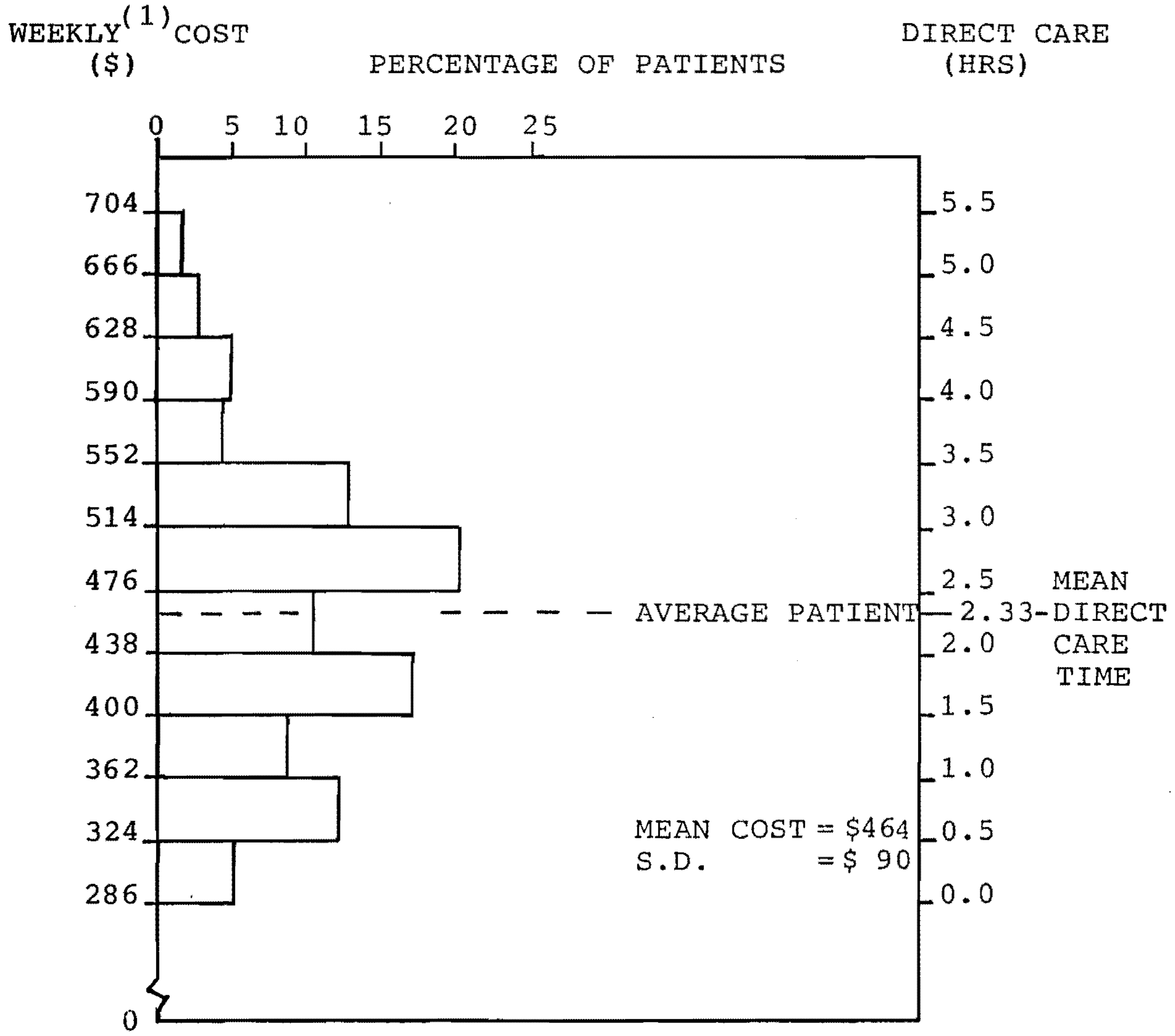
For patients with levels of disabilities such that they require substantially more than the 'average' amount of nursing care the average cost is a poor estimate of their care costs. For the 25% 'least dependent' patients (who received less than 1½ hours of direct care) the cost of care was *at least $61 per week less* than the average cost. For the 25% 'most' dependent patients (receiving 3 or more hours of

---

7 17.1% of patients received less than 1 hour of direct care. 9.4% of patients received more than 4 hours of direct care.

Figure 8.5

WEEKLY COSTS OF CARE FOR INDIVIDUAL PATIENTS AT CORONATION HOSPITAL, 1983/84



(1) This includes capital costs of $26. Subtracting this yields operating costs.

direct care) the cost of care was *at least $53 per week more* than the average cost. This means that for half the patients at the hospital the average cost overestimates or underestimates the real cost by at least $50 per week.

This analysis of the variability of the cost of care for individual patients demonstrates the importance of taking into account the level of dependency when estimating the cost of long-stay care of the elderly. The costs of public hospital long-stay care have been shown not to be a fixed amount per patient but to vary with the level of patient disabilities. The ability of the average cost to precisely estimate cost for particular patients depends upon the heterogeneity with respect to disability of the patient population. The average cost can be used in the estimation of total cost for groups of patients only so long as the average dependency remains stable. For estimates of cost for individual patients or patient groups with dependencies different from the average, the variable cost, related (through direct nursing care) to disabilities is a more precise estimator.

APPENDIX TO CHAPTER 8

NURSE STAFFING LEVELS IN MEN'S AND WOMEN'S WARDS IN PUBLIC HOSPITAL

In chapter 7 it was found that the male patients in public hospital were less dependent than the female patients and moreover that the mean direct nursing care received was significantly less (95 minutes in 24 hours compared to 161 minutes). Yet the nurse staffing levels for the men's and women's wards were the same.

Nursing personnel were aware that the workload was greater on the two women's wards and if nursing staff for these wards were absent, they were 'borrowed' from the men's ward. Therefore the actual allocation of staff may at times have been nearer to the equitable allocation.

Unlike the private hospital case, where increased inputs of nursing care in the men's hospital were associated with more direct care for male patients (compared with female patients of a similar level of disability), in the public hospital, sex was not a significant variable, when included with disability measures in a model to explain the variation in direct nursing care (see 7.6.3). In other words, in public hospital, direct care is provided in the same way, for men and women, i.e. according to disability. Provided male patients do not need more indirect care than do female (and there was no evidence that they did) then the public hospital model relating direct nursing care to patient disabilities could be used to develop a more equitable basis for staffing the wards.

CHAPTER 9

THE COST OF PRIVATE HOSPITAL LONG-STAY CARE

CONTENTS PAGE

9.1	INTRODUCTION	235
9.2	HOSPITALS SAMPLED	235
	9.2.1 Size, fees and ownership	236
	9.2.2 Dependency of Patients	242
	9.2.3 Level of Care	243
9.3	ESTIMATION OF COST COMPONENTS	246
9.4	HOTEL CARE	247
	9.4.1 Capital Costs of Accommodation	247
	9.4.2 Hotel Services	251
9.5	NURSING CARE	254
	9.5.1 Provision of the Nursing Resource	254
	9.5.2 Estimation of the average cost of Nursing Care	255
	9.5.3 Estimation of the cost of Direct Care	255
	9.5.4 Estimation of the cost of Indirect Care	257
	9.5.5 Estimation of the total cost of Nursing Care	259
9.6	MEDICAL CARE	268
	9.6.1 Doctor Time	268
	9.6.2 Pharmaceuticals and Dressings	270
9.7	OTHER HEALTH PROFESSIONAL CARE	275
9.8	THE TOTAL COST OF PRIVATE HOSPITAL LONG-STAY CARE RELATED TO DEPENDENCY	277
9.9	ESTIMATING THE COST OF PRIVATE HOSPITAL LONG-STAY CARE	281
	9.9.1 Estimates of cost by patient dependency	281
	9.9.2 Robustness of cost estimates	284
9.10	WHO BEARS THE COST?	293
	9.10.1 Hospital Operating Costs	293
	9.10.2 Capital Costs	295
	9.10.3 Extra Hospital Medical Costs	298
	9.10.4 The burden of the cost of the average long-stay patient	298
	9.10.5 The burden of cost of patients of different dependency	300
	APPENDIX - Difference in Input of Nursing Care in the Private Hospitals	303

CHAPTER 9

THE COST OF PRIVATE HOSPITAL LONG-STAY CARE

9.1 INTRODUCTION

Chapter 7 explored the relationship between patient disability and the use of the nursing resource in both public and private hospital care of the elderly. In this chapter those results will be used to estimate the cost of the nursing time consumed in private hospitals. By combining this cost with estimates of the costs of providing the other resources of private hospital care, a cost of care profile for patients of various dependencies will be obtained. The chapter concludes with a discussion of how the costs of private hospital care are shared by the patient and the state.

9.2 HOSPITALS SAMPLED

Two private hospitals, one for men, the other for women were sampled. They were owned by the same organization but administered separately on a day-to-day basis. They were chosen because in addition to offering long-term care they operated the main short-stay beds in the area and hence provided an opportunity to compare the costs of care of a group of patients (the short-stay) in two care environments: at home and in hospital.

The question arises of how representative these hospitals were of private hospitals in the area. This will be judged with respect to three parameters: size, fees, and patient dependency, in sections 9.2.1 to 9.2.3. A further sample of private hospitals was taken to explore the variation in the various components of total costs between hospitals and the results are reported in section 9.9.

9.2.1 Size, Fees and Ownership

At the time of the study there were 19 private geriatric hospitals in Christchurch offering between them 801 beds. The majority of the hospitals were owned by religious or welfare organizations and operated on a non-profit making basis. However seven were owned by private companies and were profit making.

The hospitals ranged in size from 18 to 92 beds, whilst the fees to patients were between \$147 and \$223 per week. Within this large variation however, there were several distinctive features.

The mean size was 42.16 beds but this was not indicative of the typical hospital. The distribution of size was skewed to the right (see figure 9.1). Most of the hospitals were small (10 having less than 35 beds), and the 19 hospitals formed two groups: those offering less than 50, and more than 50 beds (see table 9.1).

The mean fee was \$186.34 per week and the fees distribution was symmetrical (see figure 9.2). However the mean fee of the smaller hospitals \$183, was less (though not significantly), than the \$192 mean fee for the larger hospitals. The standard deviation of fees for the smaller hospitals, at \$18.78 was much higher than the \$8.76 for the

Figure 9.1

DISTRIBUTION OF SIZE OF PRIVATE HOSPITALS
IN CHRISTCHURCH

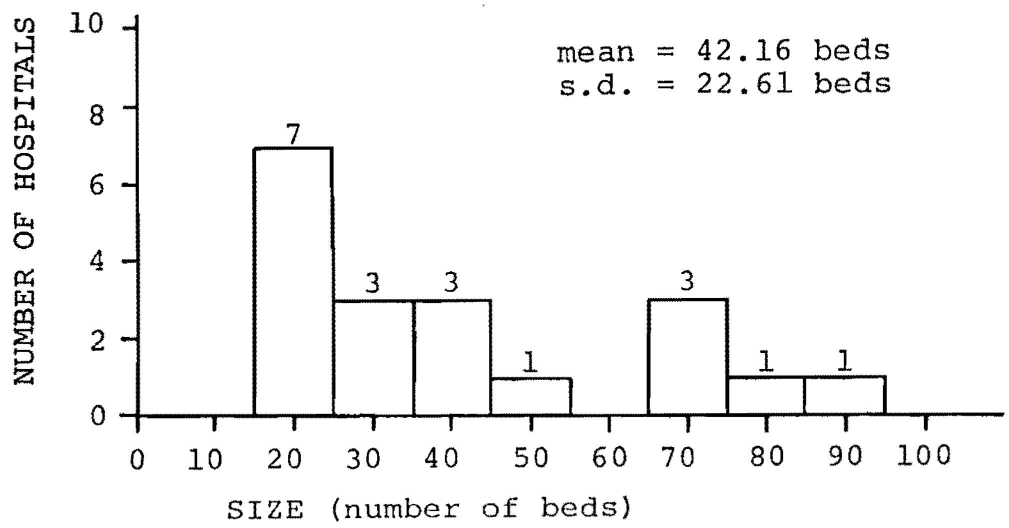


Figure 9.2

DISTRIBUTION OF FEES OF PRIVATE HOSPITALS
IN CHRISTCHURCH 1983/84

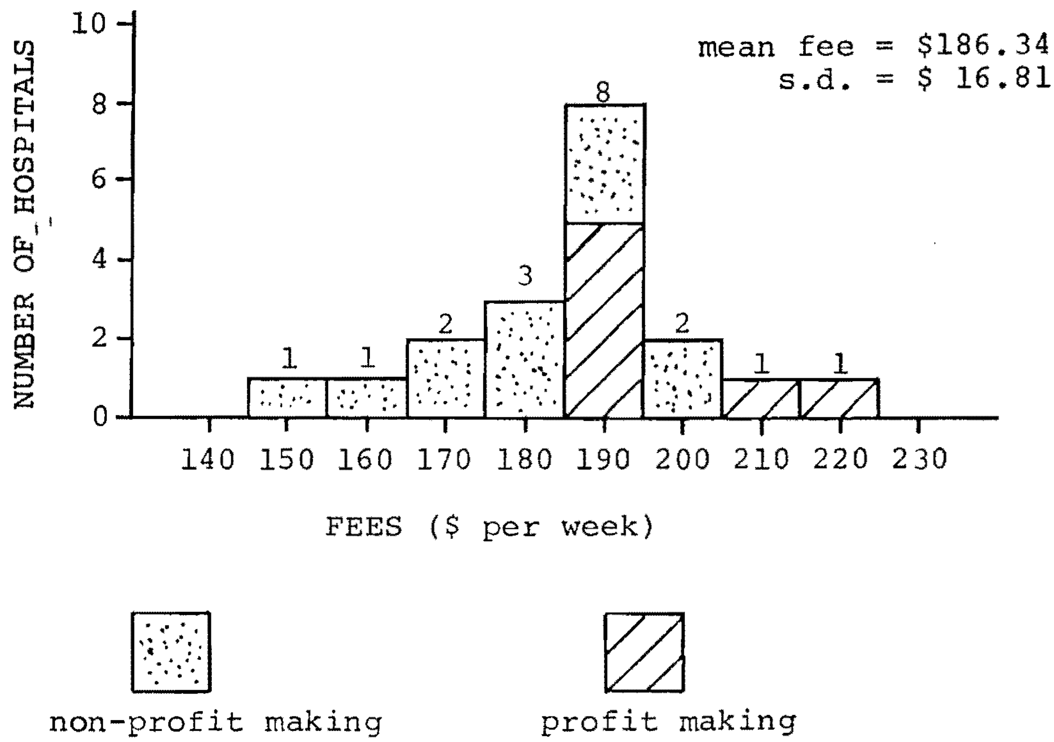


TABLE 9.1

SIZE - NUMBER OF BEDS, OF PRIVATE HOSPITALS IN CHRISTCHURCH

	Smaller Hospitals <50 beds	Larger Hospitals 750 beds	All Hospitals
Sampled hospitals (beds)	33	76	
All hospitals			
size: mean (beds)	28.23	72.33	42.16
s.d. (beds)	8.64	11.22	22.61
range (beds)	18 - 44	54 - 92	18 - 92
total beds offered	367	434	801
number of hospitals	13	6	19

TABLE 9.2

WEEKLY FEES TO PATIENTS[1] IN PRIVATE HOSPITALS IN CHRISTCHURCH 1983/84

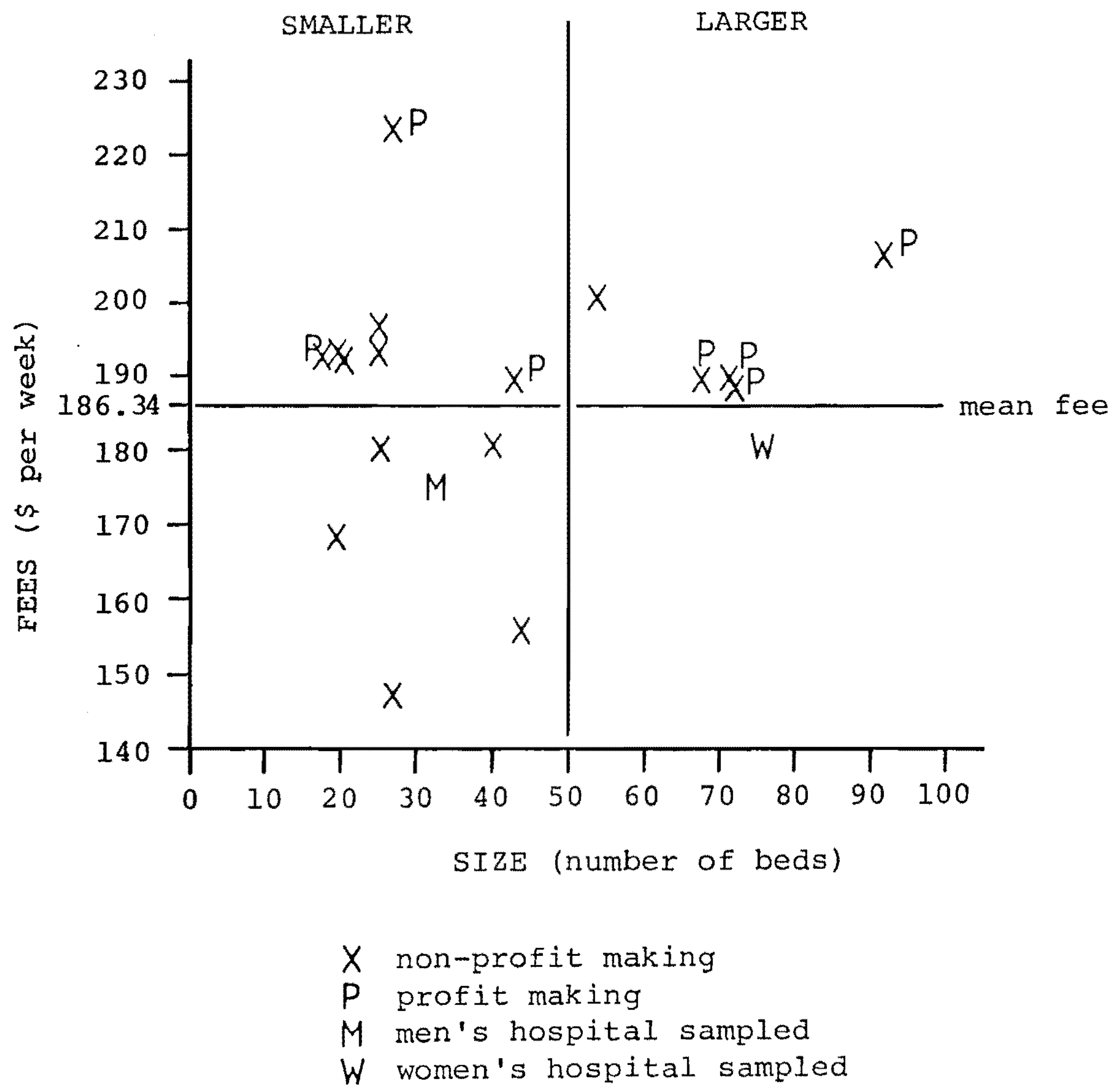
	Smaller Hospitals <50 beds	Larger Hospitals >50 beds	All Hospitals
Sampled hospitals[2] ($)	175	180	
All hospitals			
fees: mean ($)	183.55	192.39	186.34
s.d. ($)	18.78	8.76	16.81
range ($)	147 - 223	180 - 207	147 - 223

(1) This is not the whole charge. The daily bed benefit from the Department of Health contributes to the cost.

(2) The figures shown are the mean fee charged by each hospital.

Figure 9.3

SCATTER PLOT OF FEES AND SIZES
OF PRIVATE HOSPITALS IN CHRISTCHURCH
1983/84



larger hospitals (see Table 9.2) indicating greater variability in the level of fees charged. This is further illustrated in figure 9.3.

Several studies of hospital costs have found small economies of scale among hospitals (e.g. Carr and Feldstein, 1967 and Feldstein, 1967). A scatter plot of fees and size for the private geriatric hospitals is shown in figure 9.3 and indicates a weak positive relationship between the two variables. The sample correlation coefficient is 0.148, a value so close to zero that the hypothesis that there is no relationship between fees and size cannot be rejected.[1] Whether one can conclude from this that there is no significant relationship between *cost* and size depends upon how well fees reflect cost. One can expect the association to be close for non-profit making hospitals. Five of the six larger hospitals charged more than the average fee. Yet four (of these five) were profit making, hence it is likely that their costs were closer to the average costs than their fees were to the average fee. The mean fee for the (non-profit making) religious and welfare hospitals was $180.18, (s.d. = $16.00) compared to $196.90 (s.d. = $12.29) for those owned by private companies, which is significantly different at the .05 level.

A price freeze had been in effect during the time of the study and several hospitals had been unable to increase their fees. Hence data collected on fees at that time may

---

1 The sample value 0.148 was well within the 95 percent confidence interval (-0.45, + 0.45) for a population correlation of zero.

present a distorted picture of the usual variation between fees. For the group of smaller hospitals the highest fees were for the most recently opened hospital and the lowest for a hospital which had intended to increase fees.

An important component of cost is the capital investment. This may not be adequately represented in the fees charged especially if the hospital is old and loans have been repaid. This may not affect the *true* relationship between size and cost (unless there is some association with size e.g., the newer hospitals are larger) but it may account for some additional variability in fees charged, and hence affect the observed relationship between size and fees.

Tables 9.1 and 9.2 show how the sampled hospitals compare with the population of hospitals with respect to size and fees. Each of the hospitals sampled charged fees of $150.50, $187.60 and $217 according to the accommodation offered which ranged from single to seven bed rooms. In table 9.2, the average fees for each hospital have been shown.

The men's hospital was a sixty-eight year old converted property and had 33 beds. Its average fee was $175, which is less than the 'smaller hospitals' mean fee of $183.55 (and also less than the $180.18 of the non-profit making hospitals).

The women's hospital had 76 beds: 45 in a modern-purpose built block and 31 in an older converted building on the same site. Its average fee was $180, which is less than the 'larger hospitals' mean fee of $192.39, but very close to the $180.18 of the non-profit making hospitals.

In terms of size and age the hospitals sampled were typical of the private hospitals in the area. Their fees, although less than the average for the area were sufficiently close to it (being within one standard deviation) that there is no indication that the hospitals are atypical or in any way outliers. The fees charged were very close to the average fee charged by the group of non-profit making hospitals of which they formed a part.

9.2.2 Dependency of Patients

A characteristic, important in determining a hospital's costs is the type of patient cared for. The relationship between patient dependency and the use of the nursing resource has been discussed in chapter 7. Increased patient dependency will be reflected in higher nursing costs.

A survey of all elderly people in institutional care in Christchurch in 1983 (Fox) included an assessment of level of dependency. The pattern of dependency for all patients in private geriatric hospitals is shown in table 9.3. The results for the men's and women's hospital sampled are shown for comparison. Both the hospitals sampled have fewer patients in the dependent category than is the average for the area.

The criteria for partial dependency and dependency used in the survey were not very sensitive. There were two criteria: activities of daily living and personal care. Patients were classed as partially dependent if they required 'some assistance/supervision with personal care' and chapter 7 the positive relationship between dependency and the use of the nursing resource was described. Hence the short-stay patients would use less nursing time and this might therefore go towards explaining the slightly lower fees of the sampled hospitals compared with the other hospitals in the area. [However, a case could be made that these savings on nursing care costs are at least partially offset by extra administration costs arising from the high bed turnover. This matter will be reconsidered later in this chapter].

Since the cost analysis which is to follow takes account of the dependency level of the patient, then a difference in the average dependency level between the hospitals sampled and the hospital population does not invalidate the results. In fact, there will usually be differences in the 'dependency mix' of patients being cared for at various hospitals. Problems would arise if there were significant differences in the care (and therefore the inputs to care), of patients at the *same* level of dependency.

9.2.3 Level of Care

In order to compare the level of care of the hospitals sampled with other hospitals in the area, it would be necessary to collect and analyse information on staffing levels, types of patient cared for, quality of accommodation offered, nursing care and other services received by patients. This information has been obtained for the two hospitals sampled. It has been compared with that of overseas studies [Rhyd Hearn, 1979, 1983] and has demonstrated that the level of care in the hospitals sampled was at least as high as that offered in other countries. (This is reported in detail in Chapter 11).

Time and resources did not permit such detailed data collection for other hospitals in the area so that a formal comparison of level of care was not made. A minimum standard of care is ensured by the Department of Health. All the hospitals had to meet guidelines with respect to staffing levels (The Private Hospitals' Regulations, 1964) and were subject to inspection 'from time to time'. Obviously there are differences between the hospitals, particularly with respect to the physical characteristics of the accommodation offered, e.g. age of buildings, size of rooms, quality of fittings, etc.

There may also be differences in the operation of the hospitals, with variation in the style and level of the services. Some of this variation would be absorbed by differences in efficiency, but part would involve a greater or less use of resources. Since the hospitals face similar unit costs of inputs, e.g. food, salaries, power, this would be reflected in variation in total costs and ultimately in fees charged. It should be noted that long-stay hospital care is very labour-intensive, salaries accounting for 60 to 70 percent of total costs (Ward and Daldy, 1982) and that staff are governed by the same[2] pay awards (New Zealand

---

2 There was one exception. Nursing staff at the two hospitals sampled were paid public hospital rates (Nurse Maude District Nursing Association Nurse Employee's Voluntary Award 1981/82). Other private hospitals paid salaries according to the New Zealand private hospital nurses award. The differences between these were for payments for night duties and Saturday afternoon duties.

(except Westland) Private Hospital Nurses Award, 1985]. Therefore the variation in fees charged, for non-profit making hospitals may reflect to some extent the variation in the level of care, provided the hospitals work at similar levels of efficiency. Since the fees charged by the hospitals sampled were typical of those of the non-profit making hospitals then this indicates that the level of care was also similar.

The method of funding of private hospital care may have an effect on the level of care offered. A fixed capital allowance is available from the Department of Health (for religious and charitable organisations) to create further hospital beds. Any costs above this have to be funded by the hospital organisation itself and possibly would need to be passed on as higher fees to the patient.

All hospitals receive a daily bed benefit, for each occupied bed per day. The remaining cost is met by fees to the patient. An income related subsidy to the patient is available if the patient has been assessed to be in need of 24 hour nursing care. There is a limit on the total number of subsidies, in the area and the policy is to use the subsidy towards the cost of the least expensive available bed. Whether this method of funding limits fees charged and therefore level of care, depends upon the ability of patients to pay, and the number of beds available compared with the number of subsidies. At the time the data was collected there were 801 beds and 460 subsidies. There was a waiting list for these subsidies. Once a subsidy became available, a choice of beds could usually be found. Hence it would seem that the number of patients able to pay was limited and the likely effect would be for the hospitals to keep fees down. Indeed it could be argued that the presence of a large element of non-profit making hospitals puts a brake on the fees of those profit making hospitals competing for the same clients and indirectly sets a norm for the level of care in an area. There is nothing in these discussions to preclude the existence of a 'luxury' hospital, offering exceptionally high services, charging high fees and catering for a different type of client. The hospitals sampled were not in this category and do not represent this type of care. They are considered representative of the typical level of care in the area.

9.3 ESTIMATION OF COST COMPONENTS

In chapter 4, the cost components of institutional care and procedures for their estimation were detailed. In the following sections estimates are derived for care in the private hospitals sampled. The methods of estimation follow as closely as possible those used in costing public hospital care in chapter 8. Figures for operating costs are taken from the hospitals' 1983/84 annual accounts.

The objective is to determine an estimate of cost for patients of different dependencies. It has already been established in chapter 7 that the use of the nursing resource varies with patient disability and therefore nursing salaries are considered separately from other operating costs. The components of care to be costed are: hotel care, nursing care, medical care, and the care of other health professionals.

The costs to be presented are the resource costs i.e., the total expenditure on care. This involves costing not only those resources provided by the hospital, but also those obtained from other sources e.g., general practitioner services and drug prescriptions.

9.4 HOTEL CARE

The costs of hotel care are split into the capital costs i.e., for land, buildings and equipment and the costs of the hotel services e.g., catering, cleaning, administration etc.

9.4.1 Capital Costs of Accommodation

The three components of capital investment for long-stay private hospital care: land, buildings and equipment are considered in turn. Estimates are obtained of the capital value. The capital cost for each patient will be estimated from the average cost per bed offered. This is based on the assumption that the resources are shared equally between the patients.

(a) Land

The most recent (1984) government valuations of the land occupied by the two hospitals sampled were $125,000 and $320,000. Estimates of the land value per bed on this basis would be $3,788 and $4,210. These figures whilst representing the cost of the land in a broad area of the city may underestimate the opportunity costs involved in having the hospitals located where they were in a prime residential area. The market value of the land being sold in the exact vicinities of the two hospitals was approximately $2,000 and $1,800 per perch respectively. The areas of the sites were 2,797 and 8,065 square metres (85 and 106 square metres per bed). Estimates of the land value per bed based on the market value of the land would be $6,622 and $7,461.

(b) Buildings

The 1984 government valuations for the buildings of the two hospitals sampled were $125,000 and $1,713,000, ($3,788 and $22,539 per bed). The first hospital was in a converted older property. This was not an efficient form of provision in that the upper storey of the building could not be used for patients. The second hospital occupied two buildings, one a modern-purpose built block, the other an older converted property.

Two valuations, indemnity and replacement, obtained for insurance purposes, were available. The indemnity values were $24,334 and $36,894 per bed. The replacement values were $37,308 and $44,697 per bed. The former can be used to describe the cost of current provision of private hospital long-stay care. It can be used to estimate the cost of future provision provided these buildings reflect the type and level of provision the private sector wishes to offer. Additional beds could be provided at this cost if the assumption can be made that a stock of suitable buildings exists in the city. It was the opinion of the private sector hospital managers that this was not the case and that if current buildings became uneconomic to maintain or if the private sector wished to expand, then new buildings would have to be constructed. The cost of future provision of care must therefore be estimated by the cost of replacement. The replacement valuations cited above include provision for demolition and site clearance and therefore may overestimate the cost of a new building. Since capital values vary according to the type of building and the location then the figures above can be used only to give an indication of the order of magnitude of the capital investment involved in the Christchurch area. They would not necessarily apply to other areas of the country.

A capital allowance of $25,000 per bed was available from the Department of Health for the building of new (approved) hospitals by non-profit making organisations. This sum was to include land. The amount seems inadequate for the area and indeed is not intended to cover the full costs (Department of Health Circular Memorandum No. 1982/176)

(c) Furniture and Equipment

The insurance valuations for all 'loose' items of furniture were available only as aggregate figures for both hospitals. The indemnity value averaged $5,963 per bed and the replacement value $11,927 per bed.

Total Capital Value

The capital value of the land, buildings and equipment at indemnity and replacement are presented in table 9.4. The totals may be compared with the Department of Health Capital Bed Allowance of $25,000.

TABLE 9.4

CAPITAL VALUE OF ACCOMMODATION RESOURCES PER BED IN PRIVATE GERIATRIC HOSPITAL, 1984.

	Indemnity Value ($)			Replacement Value ($)		
	Hosp.1	Hosp.2	Mean (1)	Hosp.1	Hosp.2	Mean (1)
Land	6,622	7,461	7,041	6,622	7,461	7,041
Buildings	24,334	36,894	30,614	37,308	44,697	41,002
Equipment	5,963	5,963	5,963	11,927	11,927	11,927
Total	36,919	50,318	43,618	55,857	64,085	59,970

(1) The mean is calculated by (Hosp.1 + Hosp.2)/2. It is not weighted by hospital size.

Annual Cost of Capital

Using the same methods as those employed for costing public hospital care (see 8.4.1) detailed in chapter 4, the annual cost of capital for private hospital care is estimated by the annual equivalent of the capital value over the life of the asset. The figures obtained, based on the mean capital values for the two hospitals using two discount rates are shown in table 9.5, together with the capital bed allowance for comparison.

TABLE 9.5

COST PER BED PER WEEK OF CAPITAL VALUE OF ACCOMMODATION (BASED ON ANNUAL EQUIVALENT OF CAPITAL VALUE) 1984

	Discount Rate .05	.10
(a) Indemnity Valuation:		
Land (1)	6.77	13.54
Buildings (2)	31.10	59.07
Equipment (3)	14.85	18.66
Total	52.72	91.27
(b) Replacement Valuation:		
Land	6.77	13.54
Buildings	41.66	79.11
Equipment	29.70	30.15
Total	78.13	122.80
(c) Capital Bed Allowance	25.40	48.24

(1) Land is valued at perpetuity.
(2) A 'life' of 60 years is used for new buildings (40 years for existing).
(3) A life of 15 years is used for new equipment, and 10 years for current equipment.

9.4.2 Hotel Services

Annual expenditure on various hotel services were obtained from the accounts of the hospitals sampled. Estimates of the average weekly cost per patient were obtained by weighting by the average number of occupied beds (A.O.B.) i.e.,

$$\text{average cost per week} = \frac{\text{annual expenditure}}{\text{A.O.B.} \times 52}$$

These estimates are shown in table 9.6. It will be assumed (as was assumed for public hospital care) that each patient consumes approximately the same amount of each of these services regardless of the level of disability. Therefore

TABLE 9.6

ESTIMATES OF WEEKLY COST PER PATIENT
OF HOTEL SERVICES 1983/84

Service	Average cost per patient ($ per week) Hospital I	Hospital II	Mean $\frac{(I + II)}{2}$
food and catering	38.32	30.90	34.61
energy	16.68	10.61	13.64
administration	9.74	11.47	10.61
cleaning	26.93	22.24	24.58
telephone, postage, stationery, rates	2.56	3.96	3.26
laundry	10.91	10.98	10.94
gardening/maintenance	9.72	9.23	9.48
insurance	2.55	4.66	3.61
general expenses	1.93	1.63	1.78
All hotel services	119.34	105.68	112.51

the cost of a service provided to each patient will be estimated by the average cost per patient. There may be some variation between patients with respect to laundry use (as was found in public hospital), incontinent patients incurring a higher cost. However information was not collected on patients' individual use of laundry facilities, therefore the validity of the assumption cannot be tested. There may also be some variation with respect to catering costs e.g., for patients on special diets, relating to either food or food preparation costs. Most of the additional costs involved are likely to be small e.g., the labour cost of puréeing food or the extra cost of different ingredients, and it would be difficult to envisage any large variations from the average cost for individual patients.

The annual expenditure on a hotel service, which is used to estimate the mean cost per patient in table 9.6 is the total expenditure for ALL patients i.e., both long- and short-stay. It was shown in chapter 7 that the short-stay patients were significantly less dependent than the long-stay, but since it has been argued above that the use of hotel services is uniform, regardless of patient dependency, then there is no need to calculate separate cost estimates for long- and short-stay patients on account of differences in average dependency.

It was suggested in 9.2.2, however, that short-stay patients may require more administration than long-stay patients. Certainly the amount of work associated with admissions and discharges per short-stay bed would far exceed that for a long-stay bed. To some extent this would be compensated by the larger amount of work generated by long-stay patients in such activities as ongoing liaison with relatives, organizing extra-hospital medical treatment etc. The administrative workload was not analysed by types of patient so that it is not possible to measure the size of any differences in cost which may occur. The one (average) cost estimate is therefore applied to both long- and short-stay patients.

9.5 NURSING CARE

9.5.1 Provision of the Nursing Resource

Nursing care was provided by both registered nurses and unregistered nurse aides. A small number of enrolled nurses were also employed. The staffing levels varied between weekdays and weekend days. The hours offered by the two grades of staff (excluding meal breaks) on an average day, for each of the hospitals sampled are shown in table 9.7. [This can be compared with table 8.16 which portrays

TABLE 9.7

PRIVATE HOSPITALS - NURSE HOURS WORKED AND SALARIES EXPENDITURE 1983/84

Grade of Staff	Registered general nurses	Nurse aides and registered enrolled nurses	TOTAL
(I) Hospital 1			
total nurse hours per average day	41.0	56.5	97.46
salaries expenditure for year 1983/84($)	197,208	159,163	356,371
cost per hour worked ($)	13.18	7.72	10.02
average hours per patient per day	1.246	1.717	2.961
(II) Hospital 2			
total nurse hours per average day	75.57	136.92	212.49
salaries expenditure for year 1983/84($)	353,094	378,114	731,208
cost per hour worked ($)	12.80	7.57	9.43
average hours per patient per day	0.995	1.803	2.798

the staffing in public hospital]. The salaries were taken from the 1983/84 annual accounts. From this information the average cost per hour worked by each grade of staff was calculated together with the overall cost per hour on the ward.

9.5.2 Estimation of the average cost of nursing care

The average cost per occupied bed per week for the two hospitals was estimated at $208.24 and $185.17 for the average hours of care (2.961 and 2.798) provided per patient per day. However, it was shown in chapter 7 (and also in Green and Rayner 1985), that the amount of direct nursing care received by patients varies according to the level of disability. Hence the cost of nursing care will differ for individual patients. Following the same procedures as those of chapter 8 for public hospital care, the costs of direct and indirect nursing care will be estimated separately.

9.5.3 Estimation of the cost of direct care

Direct care was defined in 8.5.3 as the individual care received by a patient. The amount of time spent by nurses on direct care depends upon the disabilities of the set of patients being cared for. It will change as new patients are admitted. There will also be some effects due to the day to day variations in the conditions of existing patients.

The particular hospitals sampled had a number of short-stay patients whose average direct care time per day was less than that of the long-stay patients (see table 9.8). The proportion of these two types of patients must therefore

TABLE 9.8

MEAN DIRECT CARE TIMES, t_1, OF TYPES OF PATIENTS IN TWO PRIVATE HOSPITALS (HOURS IN 24 HOURS)

Type of Patient		Hosp.1	Hosp.2
short-stay:	mean	1.125	1.124
	s.d.	(0.730)	(0.799)
long-stay:	mean	1.535	1.643
	s.d.	(0.946)	(1.416)
typical mix:	mean	1.435	1.420
of patients	s.d.	(0.738)	(0.873)

be taken into account when estimating the amount of time spent on direct care. Hospital 1 offered on average 8 of its 33 beds and hospital 2 offered 33 of its 76 beds for short-stay care. Using these figures to calculate the relative proportions of each type of patient, estimates of the mean care time of a typical mix of patients in the two hospitals can be estimated. These estimates are shown in table 9.8.

The total amount of nurse time spent on direct care each day can be estimated at 47.23 hours for hospital 1 which accounts for 48.46% of the total hours provided. For hospital 2 the direct care time is 107.83 hours per day which is 50.75% of the total nursing time.

The cost of the direct care depends upon the grade of staff doing the work. As for public hospital costs two estimates will be obtained. The first estimate relies on the assumption (A) that all staff spend the same proportion of their time on direct care (48.46% and 50.21% for the two hospitals). Then each hour of direct care will be costed at the average hourly rate ($10.02, $9.43). The cost of t_1

hours of direct care each day for a week is estimated by:

$7(10.02)t_1$ for hospital 1

and $7(\ 9.43)t_1$ for hospital 2.

An alternative estimate can be obtained under assumption (B) that direct care is performed by aides and hence can be costed at the aide average hourly rate ($7.72, $7.57). Then the cost of a week's direct care of t_1 hours per day is estimated by:

$7(7.72)t_1$, for hospital 1

and $7(7.57)t_1$, for hospital 2.

9.5.4 Estimation of the cost of Indirect Care

Indirect care time was defined in 8.5.4 as that part of a nurse's workload which is not involved with individual patient care. The three main components of indirect care are nursing administration, patient supervision and domestic tasks. In the hospitals sampled, the first was the responsibility of the senior (registered) nursing staff. The last was undertaken almost entirely by (unregistered) nursing aides, and all staff were involved in patient supervision. The total amount of time spent on indirect care was 50.23 hours and 104.64 hours for the two hospitals (1.53 and 1.38 hours per patient respectively), accounting for 51.54% and 49.25% of the total hours worked by nursing personnel.

The two methods (I and II) of estimation of the cost of indirect care discussed in 8.5.4 are considered for private hospital care. Method I assumes that each patient receives an equal amount of indirect care ($\bar{t}_2$ minutes per day); method II assumes the amount of indirect care, t_2, varies between patients and is in proportion to the amount, t_1, of direct care received.

(1) Method I

The cost per hour, C_2, of the equal amount of direct care time, $\bar{t}_2$ received by patients depends upon the choice of method of estimation of the cost of direct care time. Using method A, i.e., assuming all staff spend the same proportion of their time on direct and indirect care then the costs per hour of indirect and direct care are equal ($C_2 = C_1$). The cost per patient per week of indirect care is estimated by $7 \times \bar{t}_2 C_2$. For hospital 1 this cost is \$107.33 and for hospital 2 the cost is \$91.19 per patient.

Using method B to estimate direct care costs i.e., costing direct care at nurse aide rates allocates annual expenditures of \$133,073 and \$297,796, to direct care, leaving \$223,298 and \$433,412 for indirect care. The total amounts of indirect care provided each day are 47.23 hours and 106.95 hours for the two hospitals. These yield estimates of \$12.18 and \$11.35 for C_2, the cost per hour of indirect care. The weekly cost of the 1.53 and 1.38 hours of indirect care received per day is estimated at \$130.48 and \$109.75 per patient.

(2) Method II

The amount of indirect care t_2 received by a patient is allowed to increase as patients become more dependent. It is assumed to vary in proportion to t_1 the direct care time.

i.e., $t_2 = \frac{t_1}{\bar{t}_1} \cdot \bar{t}_2$

For hospital 1, $t_2 = t_1\left(\frac{1.526}{1.435}\right) = 1.0634\ t_1$

For hospital 2, $t_2 = t_1\left(\frac{1.378}{1.420}\right) = 0.9705\ t_1$

The daily cost of indirect care for an individual patient can be obtained using each of the two estimates of C_2, the cost per hour of indirect care.

Under assumption A, $C_2 = C_1$. The daily cost of indirect care is estimated by

$(10.02)(1.0634 t_1) for hospital 1

and $(9.428)(0.9705 t_1) for hospital 2.

Under assumption B, the daily cost of indirect care is estimated by:

$(12.18)(1.0634 t_1) for hospital 1

and $(11.35)(0.9915 t_1) for hospital 2.

9.5.5 Estimation of the total cost of nursing care

The weekly cost of nursing care for an individual patient termed ncost, is made up of the cost of direct and indirect care, i.e.,

$$\text{ncost} = 7(C_1 t_1 + C_2 t_2)$$

Four estimates of ncost can be calculated using the two methods (A and B) for direct care costs and methods I and II for indirect care costs. They are:

AI	: $ncost = 70.3327t_1$	hospital	1
	$ncost = 66.1758t_1$	"	2
BI	: $ncost = 54.1855t_1$	"	1
	$ncost = 53.1075t_1$	"	2
AII	: $ncost = 7[10.02][t_1 + 1.0634t_1]$	"	1
	$ncost = 7[\ 9.43][t_1 + 0.9705t_1]$	"	2
BII	: $ncost = 7[\ 7.72t_1 + (12.18)(1.0634t_1)]$	"	1
	$ncost = 7[7.57t_1 + (11.35)(0.9705t_1)]$	"	2

These estimates are plotted in figures 9.4 and 9.5 for values of t_1 from zero to 6 hours. Methods AII and BII are equivalent. (This was proven in 8.5.5). For hospital 1, AII and BII give an estimate of \$145.12t_1 for the weekly cost, and for hospital 2, the cost estimate is \$130.43t_1. Figures 9.6 and 9.7 illustrate the proportion of total cost allocated to direct and indirect nursing care for each of the four methods of estimation.

The two methods (I and II) of dealing with indirect nursing care have produced quite different results in the estimates of nursing cost per patient. Method I assumes each patient receives the same amount of indirect care regardless of the amount of direct care (t_1) received, i.e., regardless of the level of dependency [since t_1 is related to levels of disabilities and can be considered as a proxy for dependency]. The total cost of nursing care varies between patients but the variation is entirely on account of the variation in *direct* nursing costs.

Method II allows the cost of indirect care to vary also. The effect is an amplification of the variation in total costs for estimates AII and BII compared with AI and

Figure 9.4

COMPARISON OF FOUR ESTIMATES OF WEEKLY COST OF NURSING CARE FOR INDIVIDUAL PATIENTS PRIVATE HOSPITAL 1, 1983/84

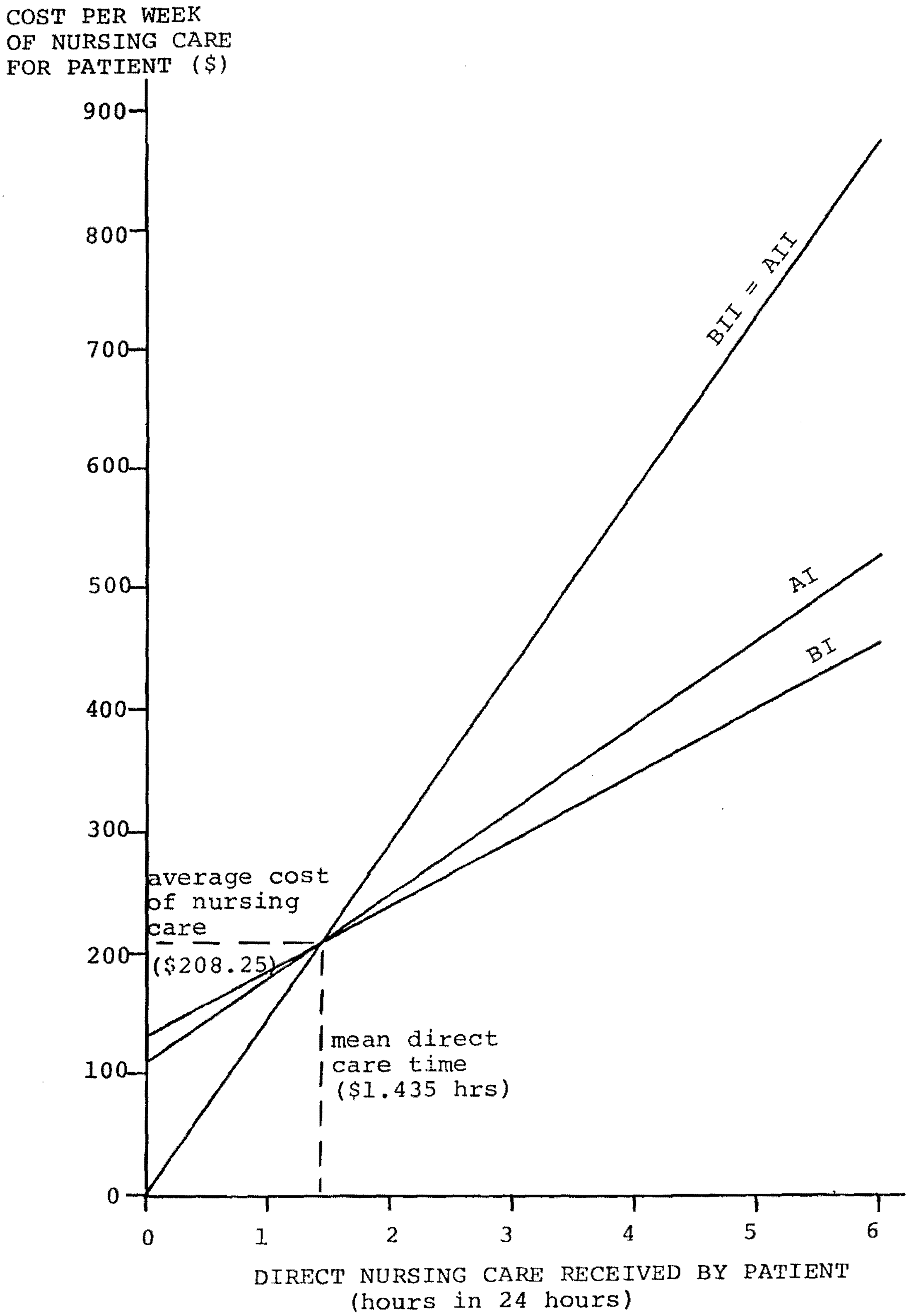


Figure 9.5

COMPARISON OF FOUR ESTIMATES OF WEEKLY
COST OF NURSING CARE FOR INDIVIDUAL PATIENTS
PRIVATE HOSPITAL 2, 1983/84

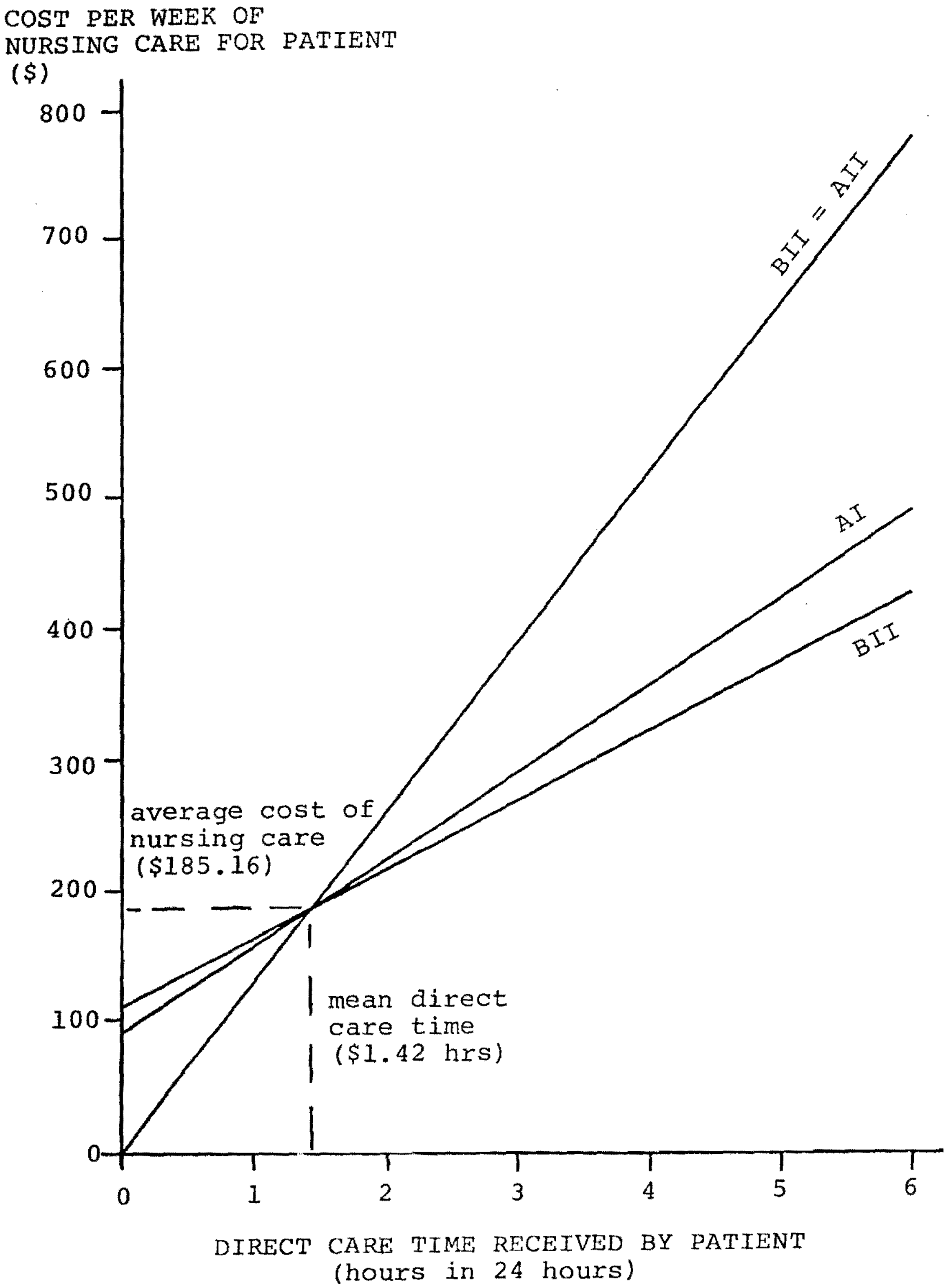
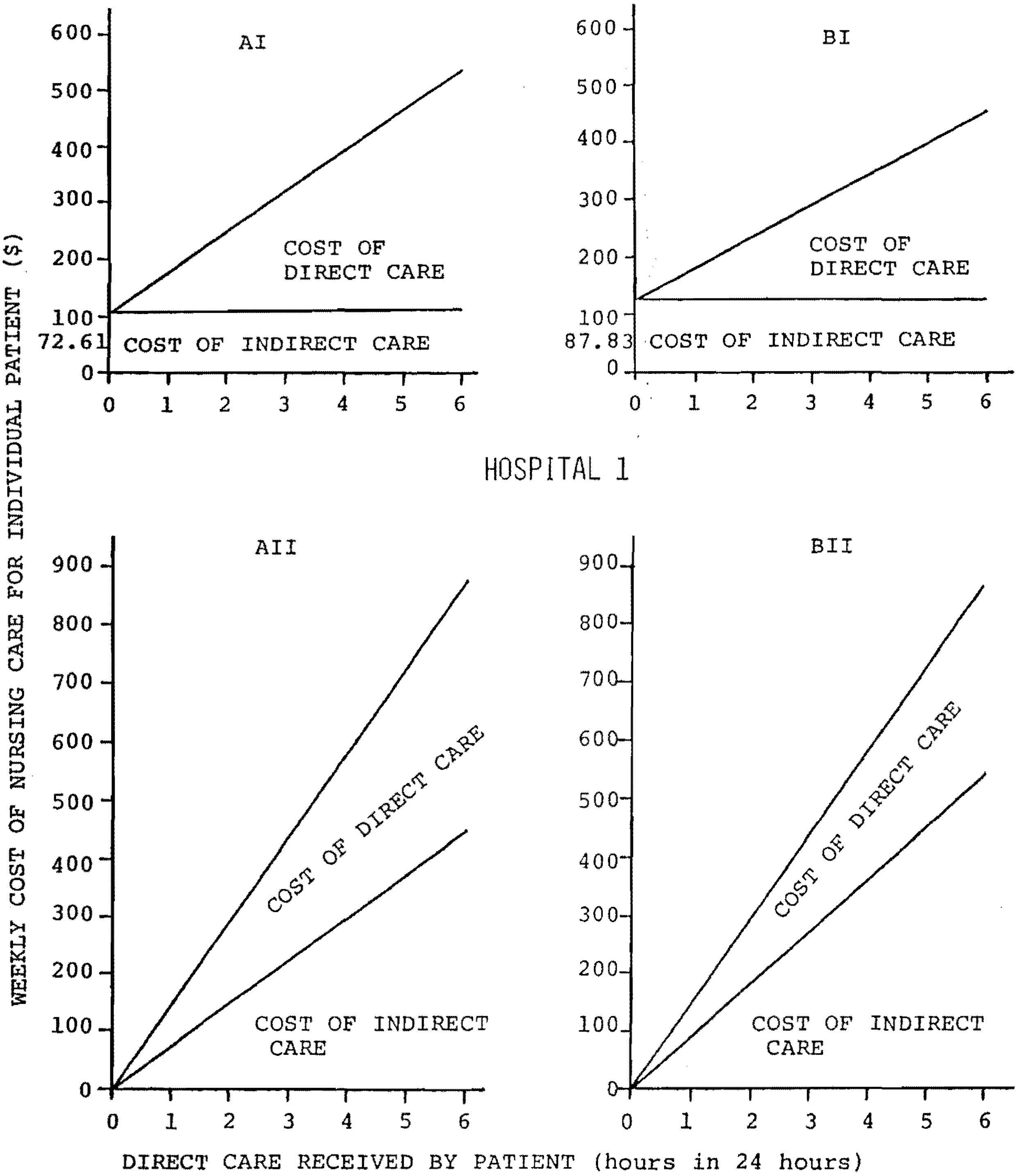


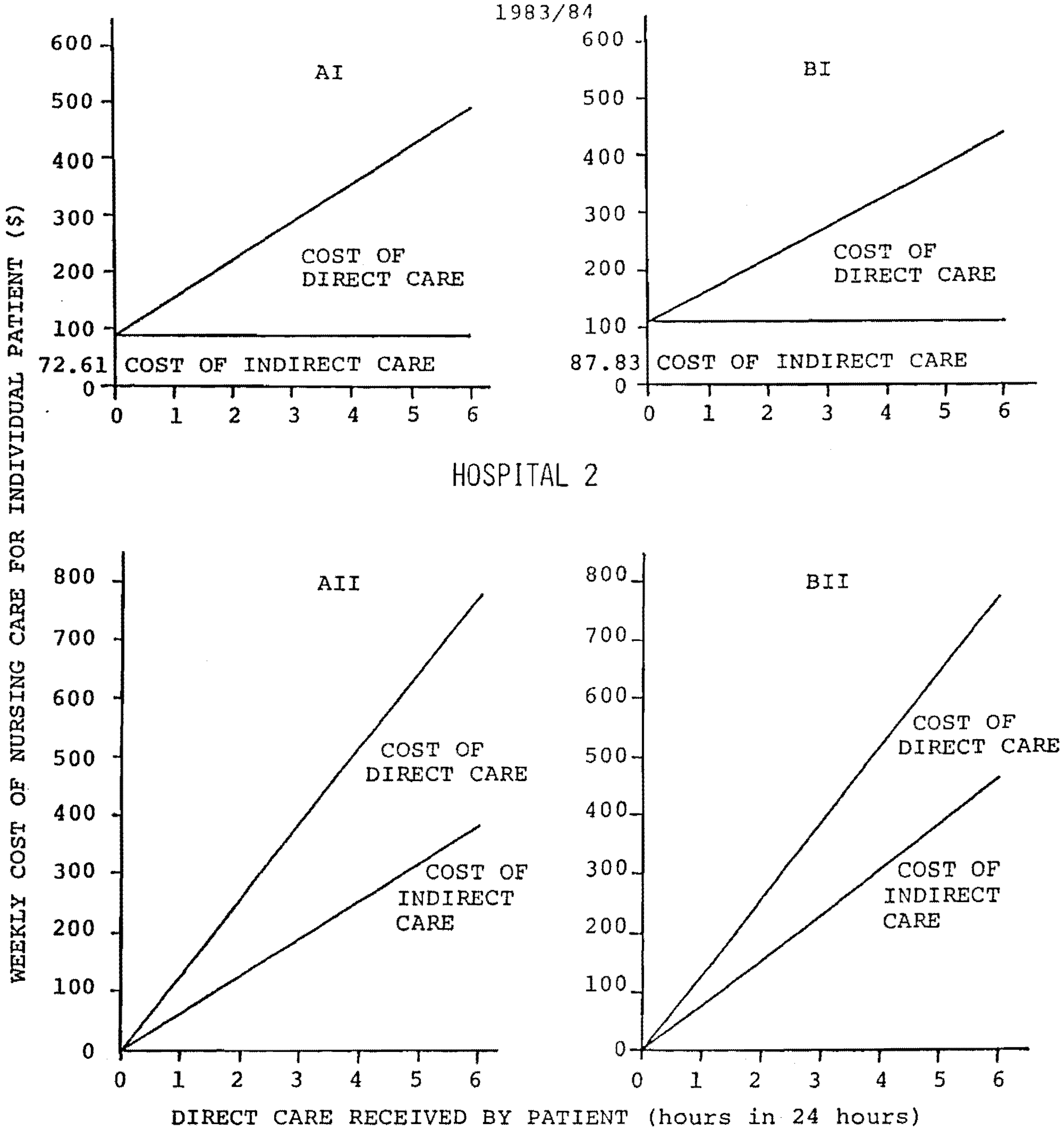
Figure 9.6 ESTIMATES OF WEEKLY COST OF NURSING CARE BASED ON FOUR SETS OF ASSUMPTIONS PRIVATE HOSPITAL 1, 1983/84



A : direct care is costed at average nursing salary rates
B : direct care is costed at nurse aide salary rates
I : the cost of indirect care is the same for each patient
II : the cost of indirect care varies with patient dependency

Figure 9.7

ESTIMATES OF WEEKLY COST OF NURSING CARE BASED ON FOUR SETS OF ASSUMPTIONS - PRIVATE HOSPITAL 2 1983/84



A : direct care is costed at average nursing salary rates
B : direct care is costed at nurse aide salary rates
I : the cost of indirect care is the same for each patient
II : the cost of indirect care varies with patient dependency

BI. It was felt by the nursing staff that although there might be some variation in indirect care between patients in private hospital it was likely to be small.[3] This duplicates the situation in public hospital care and again methods AII and BII cannot be regarded as reflecting the likely variation in nursing costs. Therefore for the same reasons as those given in 8.5.4 for the costing of public hospital care, the methods based on II are considered inappropriate and will not be proceeded with further.

Estimates of total nursing care costs using methods AI and BI are shown in table 9.9, for patients receiving between 0 and 5 hours of daily direct nursing care, in each hospital sampled. Values of direct care between these limits were recorded at each hospital. The mean cost of care is shown for comparison and it can be seen that the cost for a particular patient varies from half the average cost to more than twice the average cost. Since the direct nursing care received by a patient is a function of the patient's disabilities (Chapter 7 and Green and Rayner, 1985) then it is clear that the costs of nursing care in private hospital vary substantially between patients, according to patient dependency.

Method AI of estimation, costs both direct and indirect nursing care at the same rate (the average rate for the set of staff employed). It relies on the assumption

---

3 The main reason was that the domestic tasks, which form the major share of indirect care are approximately the same for each patient.

TABLE 9.9

ESTIMATES OF THE WEEKLY COST OF NURSING CARE IN TWO PRIVATE HOSPITALS

t_1 direct care (hours in 24 hrs)	Estimation Method AI Hosp. 1	Estimation Method AI Hosp. 2	Estimation Method BI Hosp. 1	Estimation Method BI Hosp. 2
0.0	107.33	91.19	130.48	109.75
0.5	142.49	124.28	157.57	136.30
1.0	177.66	157.37	184.67	162.85
1.5	212.83	190.45	211.76	189.41
2.0	247.99	223.54	238.86	215.96
2.5	283.16	256.63	265.95	242.52
3.0	318.33	289.72	293.04	269.07
3.5	353.49	322.81	320.14	295.62
4.0	388.66	355.89	347.23	322.18
4.5	423.82	388.98	374.33	348.73
5.0	458.99	422.07	401.42	375.28
mean	208.25	185.16	208.24	185.16
mean short-stay	186.43	165.78	191.42	169.61
mean long-stay	215.26	199.95	213.64	197.03

that both registered and unregistered staff spend the same proportion of their time on direct care (48.46% and 50.21% for the two hospitals). The most likely violation of this assumption would be if registered staff (e.g., principal nurse) spent *less* of their time on direct care than did unregistered staff). However the greater proportion of administrative work possibly required by the more dependent patients would compensate for this effect.

Method BI of estimation costs direct care at unregistered staff rates and therefore the cost variation between patients is less than under AI. If this method is used to describe the allocation of nursing care within a hospital it assumes that the only difference in the amount of nursing care, between patients of greater and lesser dependency, is an increased need for nurse aide services. In practice, however, registered nurses also spend more time on the dependent patients. Therefore method AI which allows a share of registered staff time for direct care, is a closer approximation to behaviour. This method which was used in costing public hospital care, will also be used to estimate the cost of nursing care in private hospital, for the current patient population.

If the patient population were to change, e.g., if the number of patients or their average dependency were to increase, then the costs of nursing may not rise at the full rate represented by method AI. It may be possible to accommodate extra nursing requirements by hiring only (or mainly) *unregistered* additional nursing staff, subject of course to the Department of Health regulations on the ratio of registered staff to patients. If this were so then the marginal cost of one additional hour of care would be either that of B1 i.e., based on the wage rates of unregistered staff, or would be somewhere between the rates of B1 and A1. The implications of this are considered in more detail in section 9.9.2 and chapter 11.

9.6 MEDICAL CARE

Two resources are considered in this section, doctor time and pharmaceuticals and dressings.

9.6.1 Doctor Time

In private hospital care of the elderly, medical care is under the supervision of general practitioners in the community. Some patients continue under the care of the doctor they consulted when living at home; others change to a doctor who has an arrangement with the particular hospital. The cost of the consultations is shared between the patient and the Department of Health. Doctors' visits during normal working hours qualify for a general medical services benefit [of $4 in 1983/84, and the after hours benefit was $7], paid by the Department of Health. In addition a fee to the patient may be charged.

For the long-stay patients sampled, the frequency of consultation and the fees charged, varied according to the doctor and the patient. All doctors would visit when requested. Some called regularly, e.g., every week to see all patients under their care, claiming the general medical services benefit, and charging a fee only to those patients for whom they prescribed. Others called each month and charged a fee each time.

The actual cost of doctor time for an individual patient depends on the number of consultations and the fees charged. No formal collection of this type of data was made. However, on average, long-stay patients were seen about every two weeks. Many required long-term medication and required a monthly or three monthly prescription. A sample of 75 short-stay patients had an average consultation fee whilst they were in the community of $8 (see chapter 10). Assuming that the charges per consultation to the long-stay patients are similar, the annual cost of doctor time can be estimated. Estimating 26 visits each year, 13 involving prescriptions, costing $12 ($8 patient fee plus $4 benefit) and 13 without prescriptions, costing $4 each, the annual cost would be $208 or $4 on average per patient per week. Of this sum, $2 would be borne by the Department of Health and the remaining $2 by the patient.

A further input by the Department of Health into general practitioner services is the funding of practice nurses. The cost per G.P. consultation (see Chapter 10) is $1.06. The annual cost per elderly long-stay hospital patient is $27.56. The total cost of G.P. services is therefore $236 for the year and $4.53 per week.

Consistent with the costing of public hospital care, the medical costs considered include only the regular ongoing medical care. They exclude the cost of specialist treatment obtained in either the public or private sector. These costs are an integral part of total care costs for the elderly and would need to be included to estimate the full costs. The assumption implicit in omitting these costs when making comparisons between the costs of different modes of care is that the likelihood (and the cost) of receiving specialist treatment for particular medical conditions is the same for all modes of care. This may not be true. The implications of this assumption will be considered in Chapter 11.

9.6.2 Pharmaceuticals and Dressings

In private hospital care, these resources came from two sources, each funded separately. Some non-prescription items are provided by the private hospital from its own budget. But the main source of pharmaceuticals and dressings are items prescribed by the general practitioner. These are supplied by private pharmacies and the cost is met by the Department of Health. (A charge to the patient has since been made, but this was not the case in 1983/84).

For each of the hospitals sampled, the cost per patient of non-prescribed drugs and dressings was $0.15 per week. Since this was such a small amoung, no attempt was made to estimate any cost variation between patients.

It was found that in public hospital care, the amount of medication varied between patients (see 8.6.2). The number, type and therefore the cost of the prescribed medications for patients in private hospital care can also be expected to vary and may be related to dependency. Since information was not collected on the actual drugs prescribed, then the variation of either the level or cost of medication with dependency, cannot be explored. The cost of prescribed medications will therefore be estimated by an average cost for each patient.

There is no information available in New Zealand on the cost of drugs prescribed to elderly long-stay private hospital patients. The total cost for all patients in the hospitals sampled was not measured.[4] Therefore an estimate

---

4 A separate data collection would be necessary to estimate this. It would involve costing prescriptions supplied to particular hospitals. This was beyond the resources of this project.

of the average cost of prescriptions per hospital patient will be based on existing data sources on the cost of pharmaceuticals prescribed to *all* elderly people.

The cost per person in 1983/84 of pharmaceuticals prescribed by general practitioners to persons aged 65 or more years is estimated to be $201.58 (see Chapter 10). The mean number of items prescribed is estimated at 27.58 at an average cost per item of $7.31.[5]

The mean cost of pharmaceuticals per elderly person could be used to estimate the cost for private hospital long-stay patients. But it is likely that the costs for the hospital patients would be higher, so that this estimate can be considered as a lower limit on the true cost. In order to improve the estimate it is useful to consider the mechanism by which drugs are prescribed.

The total cost of drugs prescribed in a year to the elderly patient may be considered to be the product of three factors: the cost per prescription item, the number of G.P. consultations in a year, and the prescribing rate per consultation. Using the estimate $201.59 for hospital patients assumes that the values of these three factors (for hospital patients) do not differ significantly from those for the elderly population at large or if all the three assumptions do not hold, the net effect on the total cost of pharmaceuticals, of any departures, is zero. (This latter supposition may have some validity in that the consultation rate may be higher, but the prescribing rate

5 $7.31 is the mean cost per item over items prescribed to the *whole* N.Z. population. It is assumed that the mean cost *per item* prescribed to the elderly is not significantly different from this value.

lower, for private hospital patients).

Each of the three factors will be taken in turn to consider the difference, if any, between their values for hospital patients and the general elderly population.

1. Cost per Prescription Item

There is no information available on how the cost per prescription item for elderly long-stay hospital patients compared with the mean cost per item prescribed to the general population. Therefore $7.31 will be used as the best estimate.

2. Number of G.P. Consultations

The number of G.P. consultations per person, for people in Christchurch aged 65 years or more was estimated to be 7.9 for the year 1976/77 (Malcolm, 1979). Private hospital patients represent the disabled section of the elderly population. Many of them suffer from one or more medical conditions requiring monitoring or treatment and would be expected to require a greater level of medical care than elderly in the community. Access to G.P's is easier in hospital. Utilization of G.P's depends on need but it has also been shown to depend upon availability (Malcolm and Barnett, 1980). For both these reasons the number of consultations per elderly patient in long-stay care would exceed that of the elderly population at large.

In the private hospitals sampled, long-stay patients saw a doctor on average approximately every two weeks i.e. approximately 26 consultations each year.

3. Prescribing rate per consultation

The number of items prescribed per G.P. consultation for the general elderly in the population can be estimated from:

$$\frac{\text{annual number of items prescribed}}{\text{number of consultations}} = \frac{27.58}{7.9} = 3.49 \text{ items per consultation}$$

The estimated cost of pharmaceuticals per consultation is:

$$\text{number of items prescribed} \times \text{cost per item} = 3.49 \times \$7.31$$

$$= \$25.52 \text{ per consultation}$$

However, not all consultations result in prescriptions. A study by Simpson and Squires (1985) of Christchurch data for the year 1980/81 found that items were not prescribed for 24 percent of consultations with the elderly. The number of 'prescribing consultations' can therefore be estimated by:

$$\{\text{number of consultations per year}\} \times \{\text{prescribing rate}\}$$

$$= 7.9 \times 0.74$$

$$= 5.846 \text{ prescribing consultations per year.}$$

The mean number of items resulting from each 'prescribing consultation' is:

$$\frac{\text{number of items prescribed per year}}{\text{number of 'prescribing consultations'}} = \frac{27.58}{5.846}$$

$$= 4.718 \text{ items per 'prescribing consultation'}$$

The cost of pharmaceuticals per 'prescribing consultation' can be estimated from:

$$\left\{\begin{matrix}\text{number of items} \\ \text{prescribed}\end{matrix}\right\} \times \left\{\begin{matrix}\text{cost per} \\ \text{item}\end{matrix}\right\} = 4.718 \times \$7.31$$

$$= \$34.49 \text{ per prescribing consultation.}$$

There is no information on the number of items prescribed or the cost per prescribing consultation for private hospital patients, therefore the values above, (4.718 and \$34.49) will be used as estimates. It remains to determine the incidence of prescribing and the resultant number of prescribing consultations per patient per year in private hospital.

The increased number of G.P. consultations (in hospital) may have the effect of reducing the incidence of prescribing (e.g. some consultations may be to monitor chronic conditions). The incidence in the community was 0.74. Many hospital patients were on drugs prescribed monthly which implies an incidence of prescribing of 0.5, i.e. 12 prescribing consultations per year and this value will be used in the cost estimation below.

The mean number of items prescribed per year would therefore be 56.62 (i.e. 12 × 4.718) which is higher than the average for all elderly (27.58). This would be consistent with the greater dependency of the private hospital patients compared to the general elderly in the population.

Estimation of the annual cost of pharmaceuticals

The estimates obtained above of the number of prescribing consultations a year and the cost per prescribing consultation may be used to determine an estimate of the average cost of pharmaceuticals per person in private geriatric hospital for the year 1983/84 as follows:

$$\left\{\begin{array}{l}\text{Cost of}\\ \text{pharmaceuticals}\\ \text{for 1983/84}\end{array}\right\} = \left\{\begin{array}{l}\text{number of}\\ \text{prescribing}\\ \text{consultations}\\ \text{in year}\end{array}\right\} \times \left\{\begin{array}{l}\text{cost per}\\ \text{prescribing}\\ \text{consultation}\end{array}\right\}$$

$= 12 \times \$34.49$

$= \$413.88$ per patient for the year 1983/84

This is just twice the average cost taken over all elderly in the population.

Including the cost of drugs supplied by the hospital yields a total weekly cost of $8.11 per patient for pharmaceuticals and dressings.

It must be recognized that the accuracy of this estimate is limited by the availability of data used and the validity of the assumptions made in the estimation procedure. It must thus be used with caution. It exceeds the weekly cost of pharmaceuticals and dressings in the public hospital, $7.69. But in view of the above mentioned reservations of the accuracy of the estimate, this difference should not be considered to be statistically significant.

A precise estimate of the cost of prescribed medicines in private long-stay hospitals would necessitate a detailed costing study. Since such costs represent only a small part of the total cost of long-stay care, such a data collection was not considered worthwhile. The estimate of cost obtained is an indication of the magnitude of costs likely to follow from the level of G.P. contact with patients in private hospitals.

9.7 OTHER HEALTH PROFESSIONALS

Unlike public hospital long-stay care, where all therapy and other health professional care is provided and at zero cost to the patient, patients in private hospital care obtain these resources in a variety of ways. A certain amount of health professional services are provided by the private hospitals themselves, the costs covered by the normal fee. The type and amount of the service varies between hospitals, but those most often provided are occupational therapy and physiotherapy. Some hospitals, notably those operated by church organizations, provide social work services.

Some other therapy services are arranged by the hospital e.g. chiropody, dentistry, the charge being met by the patient. On occasions the public hospital services were used (at no charge to the patient) e.g. speech therapy.

The hospitals sampled provided physiotherapy and occupational therapy. The average costs of these services per patient per week were $1.52 and $1.08. Although there may have been some variation between patients in the use of these resources, it is unlikely to have a significant effect on the variation of total patient cost. Therefore as in the costing of public hospital care, the average costs are used to estimate the costs for each patient.

The amount of any health professional services provided by *outside* organizations (either in the public or private sector), and used by the private hospital patients, has not been measured, and is not included in the cost analysis.

9.8 THE TOTAL COST OF PRIVATE HOSPITAL LONG-STAY CARE RELATED TO DEPENDENCY

In this section the costs of the major components of care are put together to obtain estimates of the total cost of care for patients of different dependencies in each of the hospitals sampled. Table 9.11 shows the average cost of care per patient in each hospital.

TABLE 9.11

AVERAGE WEEKLY RESOURCE COSTS OF CARE PER PATIENT IN TWO PRIVATE HOSPITALS 1983/84

	Hosp I ($)	Hosp II ($)	Mean ($)	Mean Long-stay Patients ($)
Resource operating costs				
hotel services	119.34	105.68	112.51	112.52
nursing care	208.24	185.17	196.71	207.61
medical, therapy care (1)	14.16	13.72	13.94	13.94
total resource operating costs (2)	341.74	304.57	323.16	334.06
Capital costs (3)				
(i) market value	78.34	104.19	91.27	91.27
(ii) replacement value	114.86	130.74	122.80	122.80
(iii) capital bed allowance	48.24	48.24	48.24	48.24
total cost (i) market value	420.08	408.76	414.43	425.33
or total cost (ii) replacement	456.60	435.31	445.96	456.86
or total cost (iii) capital bed allowance	389.98	352.81	371.40	382.30

(1) This includes medical costs borne by the patient i.e., doctors' fees and also those borne by the state i.e., prescription costs and medical services benefits.

(2) This does not include amounts allowed by the hospitals for depreciation.

(3) The capital costs are based on a discount rate of 10%.

Table 9.12 shows cost related to t_1, the hours of direct nursing care required by a patient in 24 hours. The figures shown are the total *resource* costs of care: The costs of the services provided by the hospital are augmented by the costs of complementary services provided from other sources. Figure 9.8 illustrates the variation in cost according to patient dependency and also the relative contributions of the cost components to total cost. The capital costs are based on the market valuations. Figure 9.9 shows the distribution of total individual patient cost for the 'typical mix' of short and long-stay patients found in each hospital sampled.

TABLE 9.12

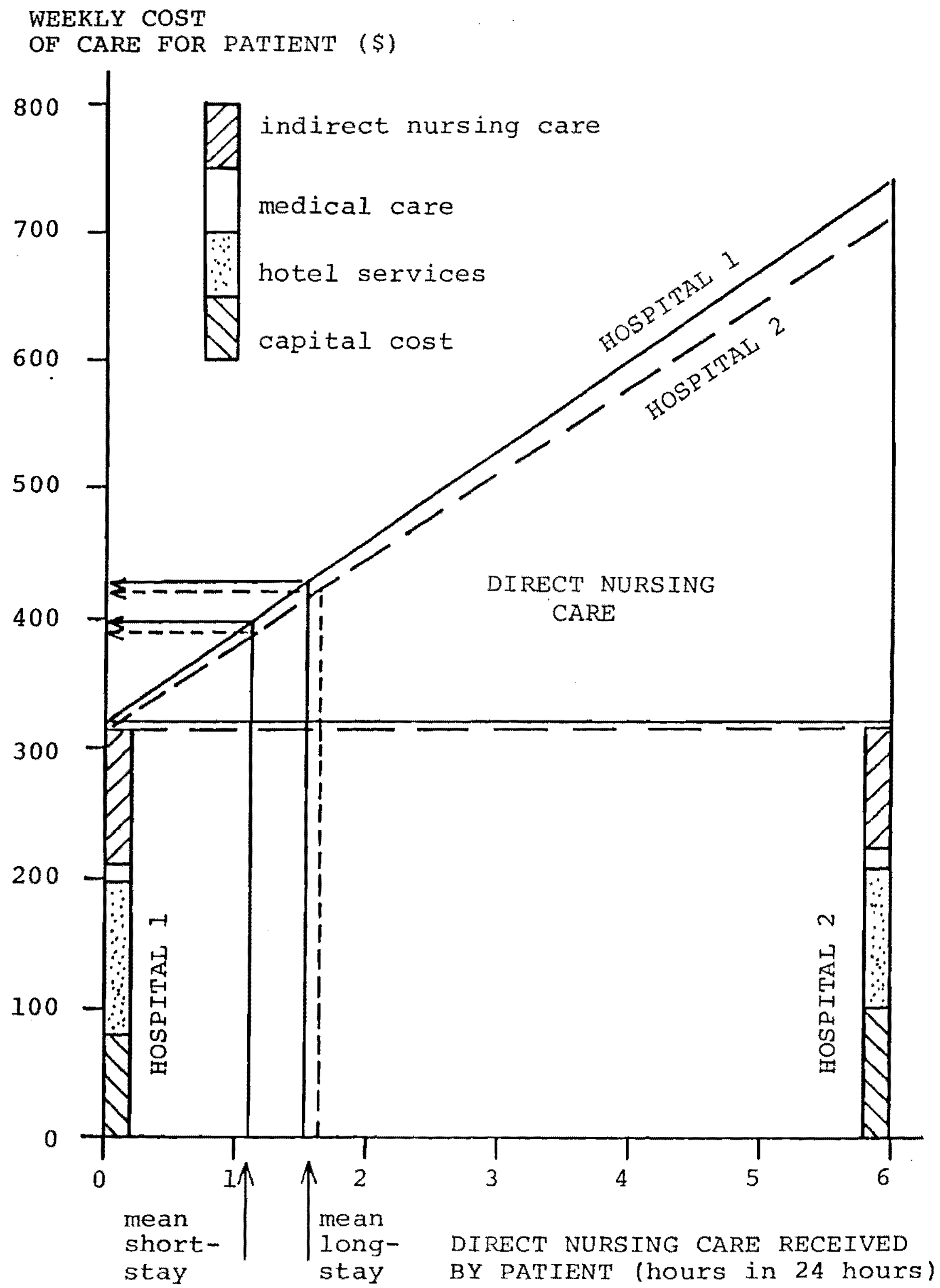
WEEKLY RESOURCE COST OF LONG-STAY PRIVATE HOSPITAL CARE, VARIABLE BY PATIENT DEPENDENCY(1)

	Hosp.I ($)	Hosp.II ($)	Mean (2) ($)
Resource operating costs:			
hotel services	119.34	105.68	112.51
nursing care	$107.33+70.33t_1$	$91.19+66.18t_1$	$99.26+68.26t_1$
medical, therapy care	14.16	13.72	13.94
total resource operating costs	$240.83+70.33t_1$	$210.59+66.18t_1$	$225.71+68.26t_1$
total costs			
(i) market value	$319.17+70.33t_1$	$314.78+66.18t_1$	$316.98+68.26t_1$
or (ii) replacement	$354.69+70.33t_1$	$341.33+66.18t_1$	$348.51+68.26t_1$
or (iii) capital bed allowance	$289.07+70.33t_1$	$258.83+66.18t_1$	$273.95+68.26t_1$

(1) t_1 is the hours of direct nursing care received by patient in 24 hours.
(2) The mean is the simple arithmetic mean i.e., it is not weighted by the number of patients in each hospital.

Figure 9.8

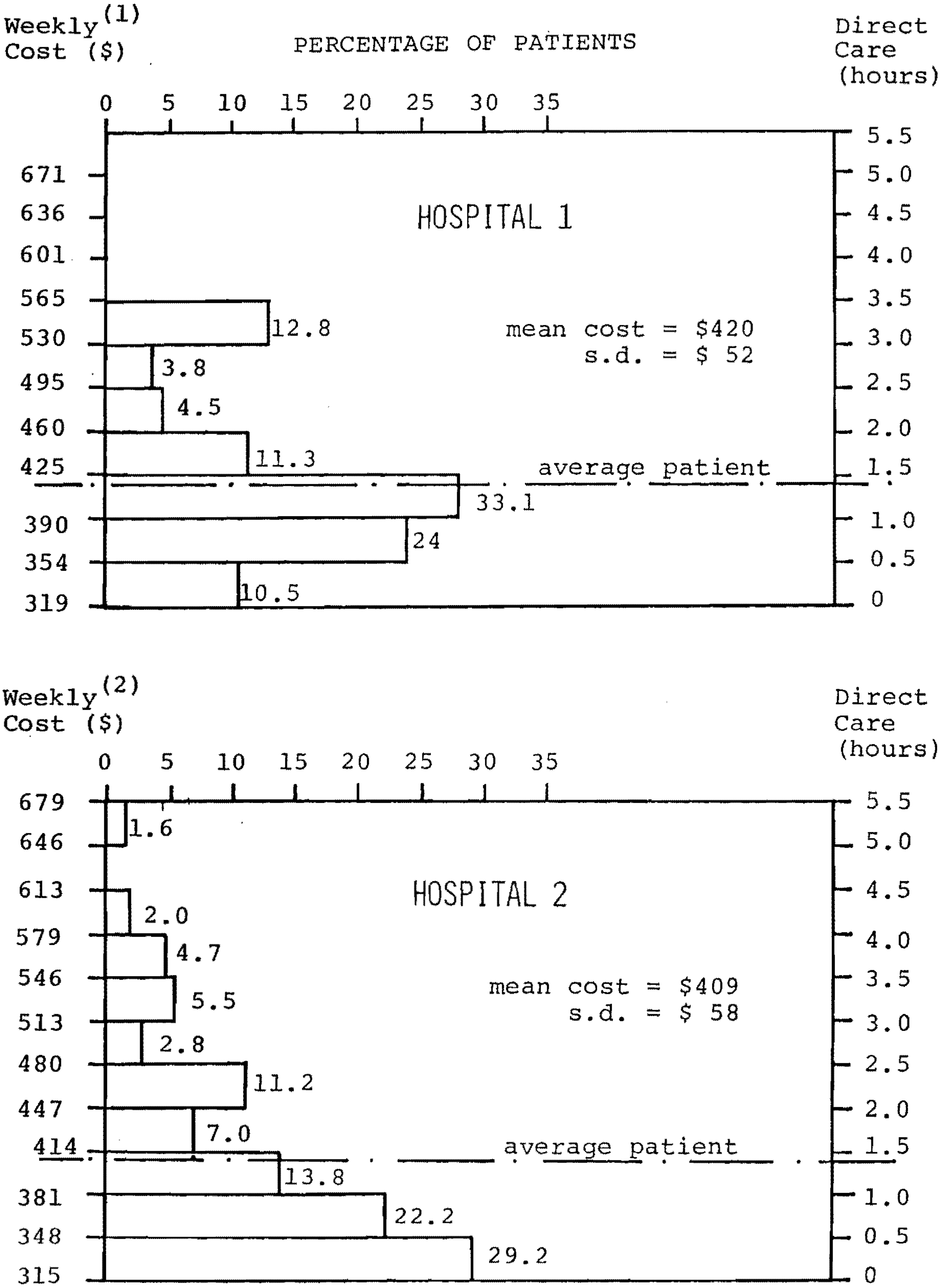
RESOURCE COST OF CARE IN TWO PRIVATE HOSPITALS 1983/84 (current provision[1])



(1) capital values used are market valuations

Figure 9.9

WEEKLY COSTS OF CARE OF 'TYPICAL MIX' OF PATIENTS IN PRIVATE HOSPITALS SAMPLED (current provision) 1983/84



(1) This includes capital cost of $78.34
(2) This includes capital cost of $104.19

9.9 ESTIMATING THE COST OF LONG-STAY PRIVATE HOSPITAL CARE

9.9.1 Estimates of Cost by Patient Dependency

The results of the analysis of the costs of the two hospitals sampled will now be used to estimate the cost of long-stay private hospital care in Christchurch.

The two hospitals differed from other private hospitals in that they offered short-stay care. The mean cost of nursing care for the short-stay patients is less than that of the long-stay patient (see table 9.9) hence the overall mean for the two hospitals (in table 9.11) is an under-estimate of the cost for long-stay patients. In order to correct for this the mean cost of nursing care can be replaced by the mean for long-stay patients and total estimates based on this, (shown in the last column of table 9.11), can be used to estimate the mean cost for long-stay private hospital care.

The variable cost mean (in the last column of table 9.12) since it is related to dependency can be used to estimate the cost of long-stay private hospital care for a patient at a particular level of dependency. Figure 9.10 illustrates the range in variation in cost between patients.

The total cost for an individual patient ranges from $334 to over $665 per week for the range of dependency observed ($t_1 = 0.25$ to $t_1 = 5.1$). This represents considerable departures from the average long-stay patient cost of $425 per week, and demonstrates the sensitivity of the total cost to the dependency of the patient.

Figure 9.11 shows the range in cost for the long-stay patients sampled in the private hospitals. The 23% least

Figure 9.10

ESTIMATE OF RESOURCE COSTS OF PRIVATE
HOSPITAL CARE FOR INDIVIDUAL PATIENTS (1983/84)

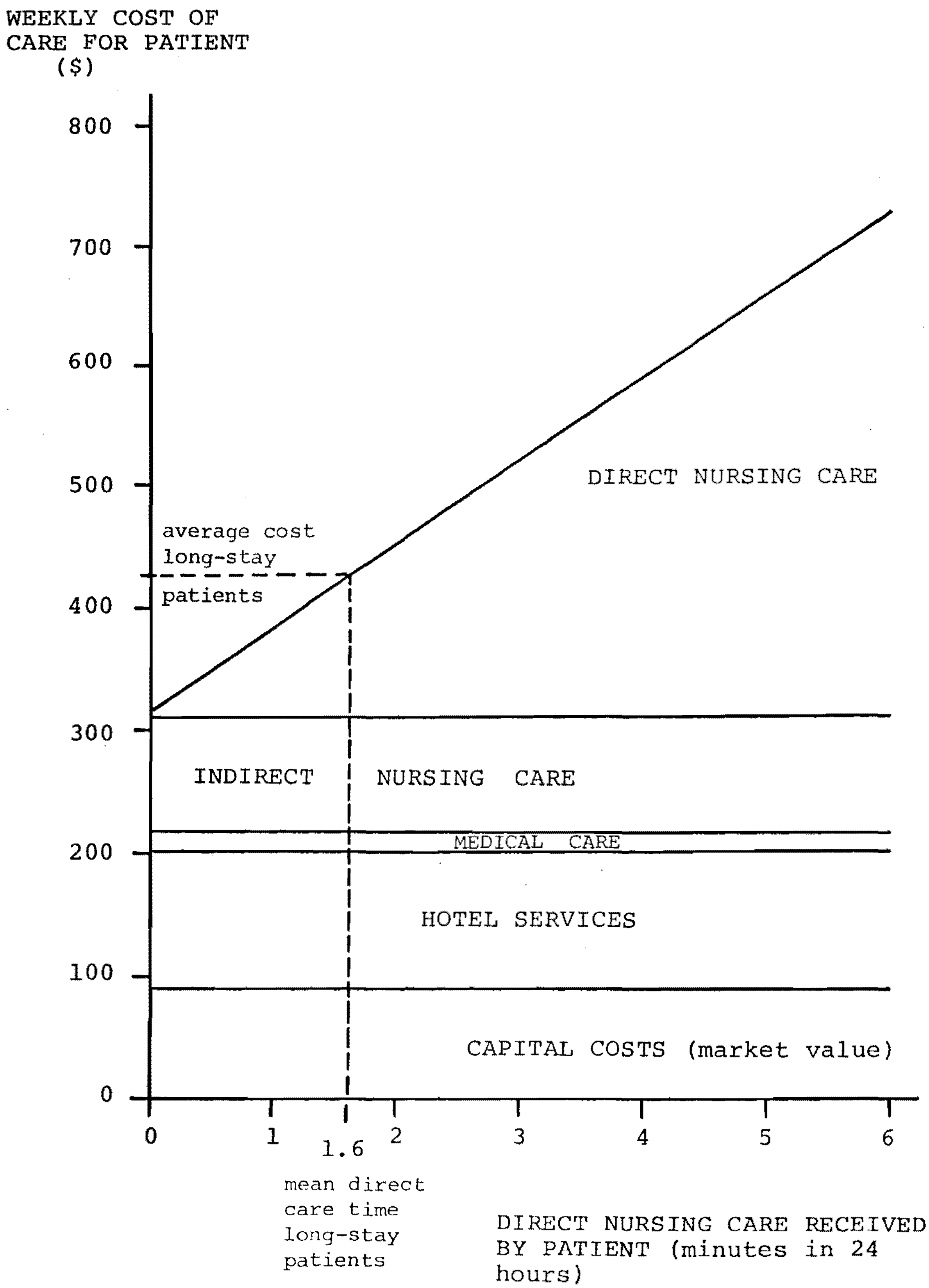
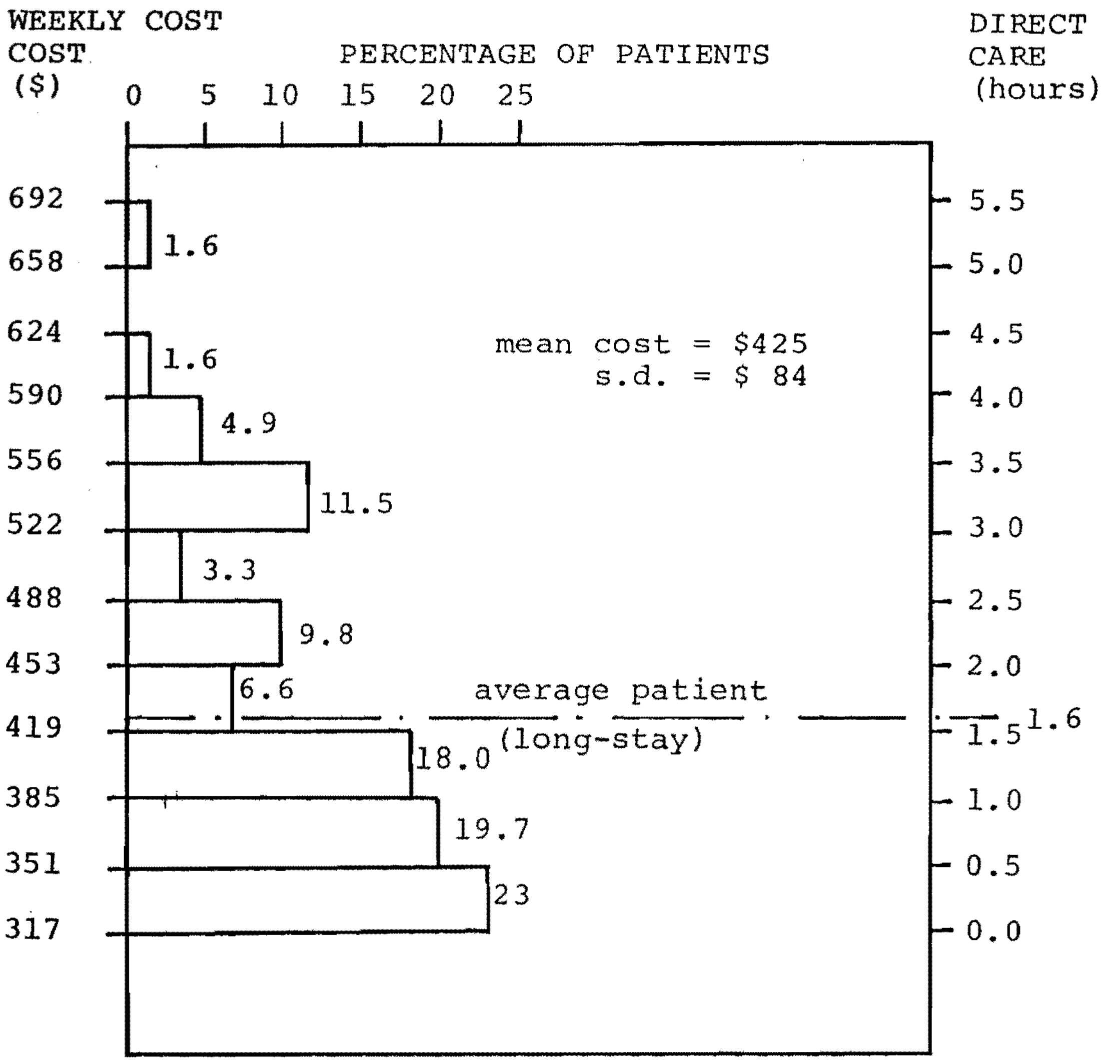


Figure 9.11

ESTIMATES OF WEEKLY COSTS OF CARE
FOR INDIVIDUAL LONG-STAY PATIENTS IN
PRIVATE HOSPITAL, 1983/84



(1) This includes capital costs of $91.27.
Subtracting this yields operating costs.

dependent patients (receiving less than half-an-hour of direct nursing care) have costs which are *at least $74 per week less* than the average cost. The 23% 'most dependent' patients (receiving over 2½ hours of care per day) have costs which are *at least $63 per week more* than the average cost. This is a similar situation to that found when costing public hospital care. Although the patients in private hospitals are less dependent 'on the average' than the long-stay public hospital patients (the direct care time was 1.59 hours compared to 2.33 hours per day), the variation between patients *within* private and *within* public hospitals is considerable. In both modes of care the weekly cost for half the patients differs from the average cost by at least $50 per week.

9.9.2 Reliability of Cost Estimates

In sections 9.2.1 to 9.2.3 the sampled hospitals were compared to the population of private hospitals in Christchurch with respect to size, fees, ownership and dependency of patients. The outcome was that the hospitals were typical of the non-profit-making hospital sector, but that on account of the short-stay patients the *average* level of dependency of patients was lower. This difference in dependency has been taken account of by basing cost estimates on the *long-stay* patients[6] in the sampled hospitals (see

---

[6] It was noted in 9.2.1 that the mean weekly fees of the sampled hospitals ($177.5) was slightly lower than that of the non-profit-making hospitals ($180.18). If the sampled hospitals accepted only long-stay patients then their nursing costs would increase. The effect on cost would be an increase of $6.58 for hospital 1 and $10.48 for hospital 2. This would presumably cause fees to rise.

Table 9.11 and figure 9.10). Nonetheless there will still be differences between the particular sets of long-stay patients being cared for in the various hospitals, as there will be in the types of accommodation and services offered, numbers and types of staff provided and levels of efficiency. Each of these could have an effect on cost.

In this section the reliability of the cost estimates (obtained in 9.9.1), as estimators of private hospital costs in Christchurch will be discussed. Since extra-hospital costs (i.e. cost of G.P's and pharmaceuticals) were estimated independently of the hospitals, only operating[7] costs incurred *at the hospitals* will be considered. The reliability of the cost estimates will be dealt with at three levels.

1. The estimate of *average hospital operating cost* per patient.
2. The estimates of the average *costs of components of care* i.e. hotel, nursing, medical, per patient.
3. The estimate of cost *related to patient dependency.*

A further sample of four hospitals was taken to explore the variation in total cost, and in the cost of components of care between private hospitals. The four hospitals sampled were all run by religious (non-profit making) organizations. They were all small[8] (mean number of beds = 23) and the mean fee was $181.50 per week. The costs of the components of care at each hospital are shown in Table 9.13 together with those of hospitals 1 and 2.

---

7 Insufficient capital cost information was available to enable any fruitful comparison between hospitals to be made.

8 Attempts to obtain cost data from some of the larger profit-making hospitals were unsuccessful.

TABLE 9.13

HOSPITAL OPERATING COST BREAKDOWNS BY COMPONENTS OF CARE, IN SIX PRIVATE HOSPITALS 1983/84

Hospital	Average cost per patient per week ($)			
	Component of care			total hospital operating cost
	'hotel' services	nursing	medical (1) & therapy	
1	119	215 (2)	1.67	336
2	106	200 (2)	1.23	307
3	117	196	11.68 (3)	325
4	114	199	3.59	316
5	97	224	3.49	325
6	73	240	2.64	317
mean (n=6)	105	212	4.05	321
standard deviation (population estimate)	(17)	(17)	(3.86)	(10)
Estimator (mean of 1 and 2)	112	208	1.45	322

(1) This includes therapy and social worker services provided by the hospitals. The full (resource) cost of medical care would include the costs of G.P. visits and prescriptions (another $12.49 per week).
(2) The nursing costs shown are the average for the *long-stay* patients.
(3) This total included a substantial cost for social workers.

The mean fee charged by the six hospitals was $180.17 and the standard deviation was $18. This equates with the mean of $180.16 (s.d. = $16) for all non-profit making hospitals in Christchurch. The cost information in Table 9.13 will be used to judge the robustness of the cost estimates obtained in 9.9.1.

1. The reliability of the average hospital operating cost estimate

The mean hospital operating cost per long-stay patient in hospitals 1 and 2, ($322 per week) is close to the mean for the six hospitals ($321 per week) and will be used to estimate the average operating costs of private hospital long-stay care in Christchurch.

The standard deviation of operating cost is $10 per week and this will be used as an estimate of the variation in cost for private hospitals.[9]

The variation between hospitals' total operating costs is quite low. It was noted in 9.2.3 that hospitals face similar input prices and constraints on standards of care. In a competitive market with a limited number of fully subsidized beds available in the area, one would expect similar costs for non-profit making hospitals facing fixed input prices. The estimates of total cost, above, are therefore likely to be reliable estimates for all non-profit making hospitals in the area.

2. <u>The reliability of the estimates of the average cost of components of care</u>

The costs of the hotel, nursing and medical components of care at each hospital are shown in Table 9.13. Considerable variation occurs between the hospitals, and this is greater than the variation between total costs (shown by the high standard deviations). Differences in the dependency mix of patients between hospitals would account for the variation in some of the cost components, particularly for nursing care (coefficient of variation = 0.08). The effect on hotel care would be minimal (e.g. for laundry costs). The variation in hotel costs (coefficient of variation = 0.16) is therefore perhaps larger than expected. Some variation would result

---

9 It should be noted here that no information has been obtained on operating costs for profit-making hospitals. Therefore it will be assumed that their costs do not differ from those of the non-profit making sector. Their average fee was higher, which allows a margin for profit.

from differences in the age of the properties (e.g. heating, maintenance costs), or the policy of the hospital (cleaning, laundry procedures, catering standards).

There were definitional problems in deciding how to allocate salaries cost to the various categories. The method used was to allocate by type of staff. But the job specifications of some staff may vary between organizations. For example nurses in some hospitals would perform tasks which in another hospital would be done by domestic staff. Again the employing by some hospitals of social workers (included in medical care) relieves nursing and administrative staff of some of their duties. This leads to an allocation of costs which may not exactly correspond to the costs of components of care and may partly explain the variation in hotel and medical costs.[10]

Each hospital has its own way of classifying costs. The estimators of the costs of components of care shown in the last row of Table 9.13 depend on the particular classifications of staff and mode of operation of the two hospitals sampled. Therefore they apply only to the two hospitals on which they were based. The mean values of the six hospitals would be better estimators of the average cost components in private hospital care in general.[11] Their standard deviations provide some information on the variation in these costs between

---

10 The very high value of medical costs for hospital 3 were on account of the high cost of social workers ($7.66 per week) part of which may belong to administration costs.

11 A much larger sample is required in order to obtain accurate estimates of the average costs of components of care.

hospitals but in view of the staff definitional problems just discussed it is not possible to say how much of this variation is due to the provision of differing amounts of a component of care and how much is due to problems of categorization of costs. The large variation in medical costs arises from the very different provision e.g. hospitals offered quite different levels of therapy care and not all hospitals employed social workers.

The conclusion from this discussion of the difficulties of classifying costs, is that unless information is available on the nature of the work of various categories of staff, very little can be inferred from comparing cost components between hospitals. It is more fruitful to confine cost comparisons to the total cost per patient.

3. The Reliability of the Estimate of Cost Related to Patient Dependency

The estimate of the hospital[12] operating costs of care by patient dependency based on hospitals 1 and 2 is given by:

$$\text{weekly cost of care} = 213 + 68t_1 , \qquad 9.1$$

for a patient receiving t_1 hours of direct nursing care per day. This involves a fixed cost component and a variable cost component. The fixed cost component (\$213) is made up of the cost of hotel services, indirect nursing care and therapy care provided at the hospitals. The variable cost component (\$$68t_1$) is the cost of the direct nursing care received by an individual patient.

12 Extra hospital costs e.g. G.P. costs are not included.

The same type of model could be used to estimate the cost for patients in other hospitals i.e.

weekly cost of care = $a + bt_1$, 9.2

and different values of a and b obtained. The question is to what extent can the estimate of equation 9.1 be used to represent the costs in other private hospitals. Data was not collected to enable an empirical investigation to be made. Therefore the question will be discussed from a theoretical viewpoint by considering how the values of a, the fixed cost component, b, the average wage rate for nursing staff, and t_1 the amount of direct nursing care received by a patient, would differ between hospitals.

The difficulties in categorizing costs referred to above relate to tasks which are mainly within the fixed costs. They should therefore not affect unduly the reliability of the aggregate fixed cost component as an estimate of the fixed cost of care in all private hospitals.

The variable cost component ($\$68t_1$) is the product of the hours of direct care (t_1) and the marginal cost ($68) of one hour of care. This term in the model of care costs is meant to reflect the increase in costs arising from increased patient dependency.

The amount of direct care, t_1, received by the *same* patient may vary from hospital to hospital depending upon the number of staff available, the nursing procedures and the ward layout. Furthermore the marginal cost of care, based on the average cost of providing an hour of nursing time depends upon the numbers of each grade of nursing staff employed. Although the Department of Health guidelines stipulate one registered nurse to every five patients there is still flexibility in the grades of other nursing staff employed. The extent to which hospitals hire part-time staff will also have an affect on the marginal cost of one hour of nursing care. There may be some compensating effect of the variations in t_1 and the marginal cost of nursing care between hospitals in that hospitals employing lower grade nursing staff (hence a lower marginal cost) may provide more hours of care (since these staff are less efficient). This effect would probably be minimal however so that in general the variable cost component of care (the slope of the total cost curve of figure 9.9) will vary between hospitals. Data on the relation between cost and dependency was collected for patients in only two private hospitals. An indication of the effect of the variation in the marginal cost of nursing care is shown by the difference in slopes of the graphs in figure 9.8.

Variation in t_1 was considered in Chapter 7 where it was shown that patients in hospital 1 received on average 11.94 minutes more direct care than patients with the *same level of dependency* in hospital 2. Gault (1982) in an analysis of nursing workload developed a model to explain patient nursing care which included a significant coefficient for a variable representing *staff available*. This concept that nurses 'keep busy' may be occurring in the hospitals sampled. Hospital 1 had a higher staffing ratio than hospital 2 (see Table 9.7). It is plausible that the extra time available per day may have been expended on additional direct care.[13]

The implication of this is that hospital 1 is more expen-

---

13 This is discussed further in the appendix to this chapter.

sive than hospital 2 for a patient of a given level of dependency. The further 11.94 minutes of care given to a patient at a given level of dependency costs an extra $14 per week. It is not possible from this study to make any judgements on what the appropriate amount of care should be for a patient at a given level of disability. It is likely that hospitals offer varying amounts of care. The interpretation of the model of the cost of care, is that t_1 is the direct care that is provided in private hospital for a patient with specific disability scores. The best estimate of t_1 is the mean for the two hospitals sampled.

The conclusion from the above analysis of how the parameters of the model of equation 9.2 are likely to differ between hospitals, is that the estimate of the fixed cost component ($213) is probably a reasonable estimate of the fixed cost of care in private hospital, but that the variable cost component may well differ for individual hospitals.

One final consideration is the use of the model if the patient population were to change e.g. become more dependent. The model of nursing care costs assumes that the marginal cost of one hour of nursing care is constant with respect to changes in patient dependency. This may be appropriate for the disability mix of the present private hospital populations. However if the average dependency were to change substantially the private hospital response may be to hire extra staff at grades lower than the average grade of the current nursing staff i.e. they would hire nurse aides rather than a mix of registered and unregistered staff. If this possibility was to be explored then model B1 of section 9.5.5 where the marginal cost is set to the unregistered nurse rate of pay would be a more appropriate model.

9.10 WHO BEARS THE COST?

This section considers how the resource costs of private hospital care are shared between the elderly person, society and the state. The resource costs are separated into hospital operating costs, capital costs, and extra-hospital medical costs.

9.10.1 Hospital Operating Costs

There are two sources of funds for operating costs of private hospitals. The Department of Health pays a bed benefit (of $23.50 in 1983/84) per occupied bed day. This is a fixed amount regardless of patient disability. Since geriatric hospitals have very high occupancy rates, observed by Ward (1980) to be between 96 percent and 99 percent in the year 1979/80 then it can be assumed that the bed benefit would be paid each day and therefore the weekly contribution to the hospitals' operating costs from the Department of Health would be $154.50 per bed. The fees charged to patients, again a fixed amount regardless of disability, also contribute to the hospitals' operating costs. The mean fee for the two hospitals sampled was $177.50, giving an income of $342 per week per long-stay patient, almost equally split between the public and private purse. However some patients received a subsidy from the Canterbury Hospital Board towards their fees. In order to receive this, patients had to be assessed (by the Geriatric Assessment and Rehabilitation Unit) to be in need of hospital long-term care. The subsidies were limited: 460 were available in 1983/84. The subsidy was income related so that a varying amount was paid to each patient. Information was not available on the number of patients receiving subsidies at the hospitals sampled, nor on the amount of subsidy per patient. However the total amount paid out in subsidies during the year 1983/84 was $1,869,608 (Annual Report, NCHB, 1984) so that the mean subsidy was $78.16 per person per week. For subsidized patients then, the contribution from the public purse is increased by this amount, but the total hospital income is unchanged.

If the operating cost exceeded the total income from patient fees and the bed subsidies, the hospital sustained the loss from its other funds. The mean operating cost for the long-stay patients at the two hospitals sampled was $321.57, (less than $342). The bed benefit is supplemented by $157.07 from the patient's fee to cover this operating cost leaving an operating surplus of $20.43 towards capital expenditure. The breakdown of sources of funds for operating cost are shown in Table 9.14 for subsidized and non-subsidized patients separately.

For those patients receiving subsidies, the average cost to the public purse was just over 75 percent of operating costs; for patients without subsidies the public contribution drops to just over 50 percent.

It should be noted here that the same average cost has been used for both types of long-stay patient. No information is available to the contrary. The costs may indeed be the same and the reason why some patients are not subsidized could be because the number of subsidies is limited or because the patient's income is too high for her to receive one. On the other hand the non-subsidized patients may be less dependent and therefore not qualify for the subsidy. If this is the

TABLE 9.14

SOURCES OF FUNDING FOR OPERATING COSTS FOR PRIVATE HOSPITALS 1983/84

	Subsidized Patient		Non-subsidized Patient	
Source of Funding	Amount per bed per week ($)	%age of funding	Amount per bed per week ($)	%age of funding
Department of Health (cost to public)	164.50	48.1	164.50	48.1
CHB Subsidy (cost to public)	78.16	22.9	-	0
Cost to Elderly	99.34	29.0	177.50	51.9
Operating Income	342.00	100.0	342.00	100.0
Total(1) Operating Cost	321.57	94.0	321.57	94.0
Operating Surplus	20.43	6.0	20.43	6.0

(1) The figures shown are the mean operating costs for long-stay patients in the two hospitals sampled.

case then their operating costs will be less than $321.57 and the percentages in Table 9.14 of the sources of funds for these patients are inaccurate. The effect of varying dependency levels on sources of funding is considered in 9.10.5.

9.10.2 Capital Costs

(a) Non-profit making hospitals

A capital subsidy from the Department of Health was available for religious and welfare (non-profit making) organizations to provide additional approved hospital beds. The subsidy was up to $25,000 per bed towards the cost of land and buildings (but not equipment). Certain conditions were attached including the stipulation that if the property ceased to be used as a hospital then the subsidy had to be repaid. Any costs over and above the capital bed subsidy were met by the organization (e.g. by funding raising or from legacies, endowments, etc.). There had been no recent additional beds provided in the area by the non-profit making hospitals and no detailed information was available on the proportion of total capital costs met by the subsidy. The average market value of the properties (and equipment) of the two hospitals sampled was $91.27 per bed per week. The annual equivalent of the capital subsidy (using an interest rate of 10 percent) is $48.24 per week which is 52.85 percent of this market value.

There was no state subsidy to cover replacement of equipment.[14] Any operating surplus (income - operating costs) was retained to offset future capital expenditure. The average operating surplus for the two hospitals sampled was $22.83 per patient per week in 1983/84. However since the hospitals contained a mix of long- and short-stay patients funded in different ways, this amount would vary between patients. For the long-stay patients it averaged $20.43 in 1983/84. This figure would vary from year to year for the two hospitals according to the particular income and costs incurred in a year. There would also be variation in the value of operating surpluses or losses between all the hospitals

---

14 Amounts for capital depreciation were allowed for in the fees charged, but these are less than the full resource cost of capital. The mean value for six hospitals in the area was $7.14 (s.d.=$2.58) per patient per week. For the two hospitals sampled depreciation amounted to $3.41 and $6.33 (mean $4.87) per patient per week. Depreciation was calculated according to general accounting principles at 1 percent of cost for concrete buildings, 2½ percent for wooden buildings, 10 percent for plant and equipment and 20 percent for soft furnishings and small items.

in the area.[15] Therefore this figure, which contributes 22.4 percent towards the cost of capital is at best only an indication of the order of magnitude of this source of support for capital. However, from the available data it is clear that the income of these non-profit making hospitals is not sufficient to cover the cost of capital.

The sources of funds for capital expenditure are presented in Table 9.15. The figures shown are the mean for the two

TABLE 9.15

SOURCES OF FUNDS FOR CAPITAL EXPENDITURE
FOR TWO NON-PROFIT MAKING PRIVATE HOSPITALS,
PER BED PER WEEK 1983/84

Source of Funding	Amount per bed per week ($)	Percentage
Department of Health	48.24	52.9
Portion of Patient Fees (1)	20.43	22.4
Shortfall	22.60	24.7
Total Capital Cost (2)	91.27	100.0

(1) This is the average amount left over from income for the LONG-STAY patient after their operating costs have been deducted ($342 - $321.57) - see Table 9.14.
(2) This is the cost based on the market valuation of the hospitals.

hospitals sampled. The Capital Bed Subsidy and patient fees cover only about three quarters of the cost of capital, based on the market value of the hospitals. If the replacement value had been used, the underprovision would have been even more. In order to make up the shortfall, the (non-profit making)

15 Operating surplus information on the other four hospitals sampled was very diverse and is not used for estimation. Two of the hospitals made surpluses and two suffered losses in the year 1983/84. Three of the hospitals were part of hospital-residential home complexes. Surplus or loss was recorded only for the complex and since residential homes are funded quite differently, the size of the surplus is not pertinent to this discussion on hospital costs.

hospitals use their own funds, built up from legacies or other donations, or they embark on fund-raising activities. Without this additional source of income, many of these hospitals would be economically unviable. In effect, patients in these hospitals are undercharged, and are subsidized by the donating public.

(b) Profit-making hospitals

Profit-making hospitals receive no state support for capital expenditure. Neither can they rely on donations. All capital expenditure must be financed from operating surpluses and therefore is borne by the patient.[16] This may partially explain the higher fees charged by the profit-making hospitals (see 9.2.1).

9.10.3 Extra-hospital Medical Costs

In sections 9.6 and 9.7 the costs of medical and other health professional care were estimated at $13.95 per patient per week of which $1.45 was covered by the hospital's operating costs. The other goods and services are G.P. consultations and pharmaceuticals which are provided outside the hospital and the mean cost per patient was $12.49 per week. Of this, $2 is met by the patient and $10.49 by the Department of Health (see Table 9.16).

9.10.4 The Burden of Cost of the Average Long-Stay Patient

The results of sections 9.10.1 to 9.10.3 may be drawn together to estimate the share of the resource cost of private hospital care of the average long-stay patient, borne by the

---

16 The Department of Health daily bed benefit, paid to all private hospitals is for operating, not capital, costs.

TABLE 9.16

SOURCES OF FUNDING FOR EXTRA-HOSPITAL MEDICAL CARE, 1983/84

Source of Funding	Amount per bed per week ($)	Percentage
Department of Health (cost to government)	10.49	84.0
Patient (cost to elderly)	2.00	16.0
Total[(1)] extra-medical cost	12.49	100.0

(1) As discussed in 9.6 and 9.7 this cost does not include the cost of any specialist medical services for acute conditions e.g. operations.

public purse and the elderly patient. This information is presented in Table 9.17. The shortfall is also shown.

TABLE 9.17

THE SOURCES OF FUNDING OF THE TOTAL RESOURCE COST OF PRIVATE HOSPITAL CARE OF THE AVERAGE LONG-STAY PATIENT

	Source of funding ($ per week)[(1)]			
	Public Purse	Elderly Patient	Shortfall	Total ($)
Capital Costs	48.24	20.43	22.60	91.27
Operating Costs	164.50 (242.66)	157.07 (78.91)	-	321.57
Extra-hospital Medical Costs	10.49	2.00	-	12.49
Total	223.23 (301.39)	179.50 (101.34)	22.60	425.33
Percentage	52.5 (70.9)	42.2 (23.8)	5.3	100.0

(1) The figures in brackets refer to the subsidized patients. For a patient who is not receiving a subsidy the resource cost $425.33 per week, of the care of the average long-stay patient is shared almost equally between the public and private purse. However if a patient is subsidized the public share increases to just over 70 percent.

9.10.5 The Burden of Cost of Patients of Differing Dependency

In the previous section the burden of cost between the public and private purse was estimated using the cost of the average long-stay patients. Yet in the hospitals sampled (and also in the private hospital population in general) the patients being cared for are at different levels of dependency and their individual costs of care vary (see figure 9.11).

The main variation in cost is on account of the differing nursing requirements between patients, and the cost of this resource is included in the hospitals' operating cost. The expression for operating cost can be obtained by subtracting the extra-hospital medical costs ($12.49) from the estimate of resource operating cost in Table 9.12, i.e. Hospital Operating Cost = $\$213.22 + 68.26t_1$, dollars per week.

TABLE 9.18

OPERATING COSTS IN PRIVATE HOSPITAL
FOR PATIENTS OF DIFFERING DEPENDENCIES
1983/84 ($ PER WEEK)

	Dependency of Patient			
	Low	Average	High	Highest Recorded
Direct Nursing Care Time (Hrs)	0.5	1.59	3.0	5.1
Hospital Operating Costs for Patient	247	322	418	560
Income per patient (Fee + Subsidy)	342	342	342	342
Public contribution (%age of costs)	164.50	164.50	164.50	164.50
Shortfall (Cost - Income)	-96	-20	76	218

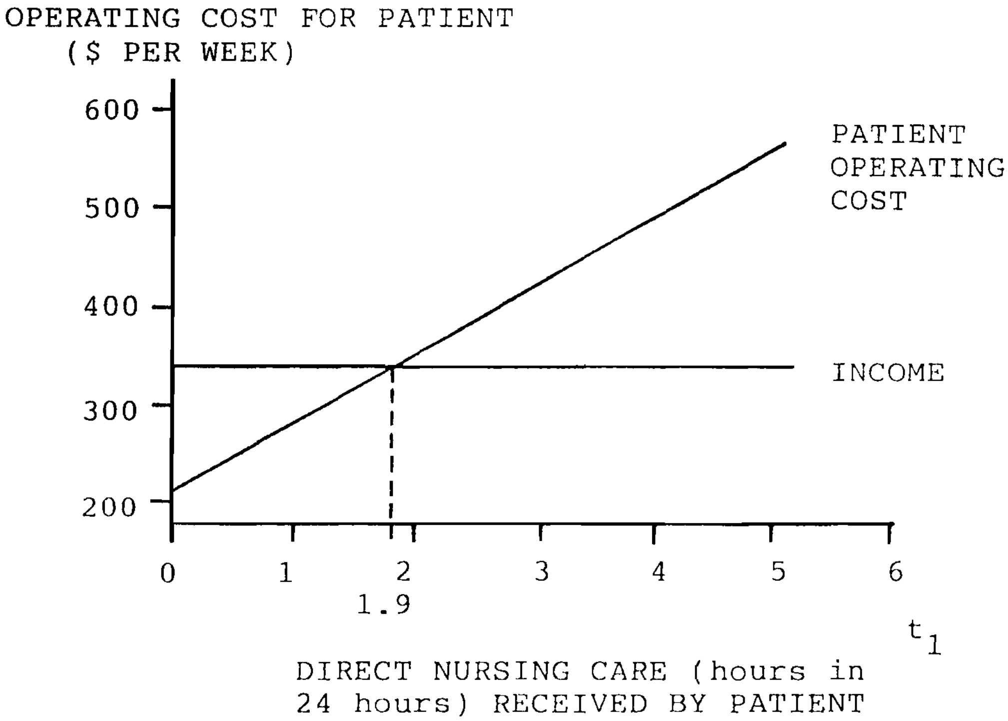
In Table 9.18 the hospital operating costs for patients of different dependencies are presented and can be compared with the fixed income to the hospitals of $342 per patient.

The shortfall (cost - income) increases as dependency rises. The shortfall for the patient of greatest dependency observed in the hospitals sampled was $218 per week.

The relationship between operating cost and patient dependency is illustrated in figure 9.12. The income of $342 per patient meets the operating costs for patients receiving up to 1.9 hours of direct nursing care, in the hospitals sampled (although at this limit there would be no margin for capital costs). For patients more dependent than this, the additional cost would be met from savings made on the less dependent patients. Quite clearly the ability to manage the budget depends upon the disability mix of the patients being cared for. The proportion of patients for whom cost exceeded income would be expected to vary between hospitals. For the hospitals sampled one third of the long-stay patients were estimated to be in this category.

FIGURE 9.11

OPERATING COSTS RELATED TO DIRECT NURSING CARE IN PRIVATE HOSPITALS 1983/84



From the analysis above, there is no incentive, from the income point of view, to admit very dependent rather than less dependent patients. If the non-profit making hospitals take in sufficient numbers of very dependent patients such that their costs exceed the income, then they must subsidize their operations from other funds, but the profit-making hospitals must charge higher fees to remain economically viable. This may explain the higher fees yet lower average dependency (Sainsbury, Fox and Shelton, 1986) of the profit making compared to the non-profit making hospitals.

It may be noted (from Table 9.18) that as dependency increases, the public contribution to cost (i.e. the state subsidy) declines as a percentage of total cost (from 66 percent to 29.4 percent). Hence the nature of the state subsidy does not encourage the admission of the most dependent elderly. This effect would be felt most strongly by the profit making hospitals. These results indicate a need for a variable patient subsidy, linked to dependency. This will be discussed in Chapter 12.

APPENDIX TO CHAPTER 9

DIFFERENCE IN INPUT OF NURSING CARE IN THE PRIVATE HOSPITALS

It was found in chapter 7 (section 7.6.2) that the direct nursing care received by patients in the men's hospital was higher by 11.944 minutes per patient per day, than that received by patients in the women's hospital. This result was obtained after allowing for differences in dependency between patients at each hospital. The value 11.944 was the estimate of co-efficient HOSP, (depicting the hospital where the patient was situated) in a model relating direct nursing care to independent variables which included measures of patient dependency (see Table 7.18).

Jellinek (1967) has postulated that the direct nursing care is a function of the staff time available as well as the dependency of the patients. From Table 9.7 in section 9.5.1 it can be seen that the provision of nursing staff in the men's hospital is higher than in the women's hospital viz 2.961 hours available per patient per day, compared to 2.798 hours. This is an extra 10 minutes per patient in the men's hospital. This extra available nurse time is sufficient to account for most of the extra direct nursing care given to the patients in the men's hospital.

An interesting feature of the allocation of the extra time is that it is uniform over all patients, within the limits of the variables specified in the model i.e. the Chow test showed that separate models for each hospital did not perform significantly better than the combined model (see Table 7.2.1) and that the difference between the hospitals could be represented by a shift in the constant (equal to the value of the HOSP coefficient). Therefore the additional nursing time available was allocated evenly between the patients rather than being related to patient dependency e.g. by giving more to the very dependent patients. The argument may be turned around and considered from the viewpoint of the women's hospital. Faced with a lower input of nursing care, the rationing is such that the input to each patient is reduced by the same amount.